



SMALL BUSINESS INNOVATION RESEARCH PHASE I

Program Solicitation No. PR-NC-01-11782

ISSUE DATE: March 29, 2001

CLOSING DATE: May 24, 2001 *

* CAUTION - See Section VI, Paragraph J.9(c), Instructions to Offerors,
concerning Late Proposals and Modifications.

Table of Contents

	Page
I. Program Description	3
II. Eligibility	4
III. Definitions	5
IV. Proposal Preparation Instructions and Requirements	6
V. Method of Selection and Evaluation Criteria	9
VI. Considerations	10
VII. Submission of Proposals	17
VIII. Scientific and Technical Information Sources	17
IX. FY2002 SBIR Phase I Research Topics	17
A. Nanomaterials and Clean Technology	18
B. Control and Monitoring of Mobile Source Emissions	20
C. Prevention and Control of Air Pollution	21
D. Treatment and Monitoring of Drinking Water	23
E. Wastewater Treatment and Stormwater Management	25
F. Hazardous Waste Management and Site Remediation	27
G. Recycling of Municipal and Industrial Solid Waste	28
H. Monitoring and Measurement Technologies	29
X. Submission Forms and Certifications	33

APPENDICES

APPENDIX A - Proposal Cover Sheet	35
APPENDIX B - Project Summary	36
APPENDIX C - SBIR Proposal Summary Budget	37
APPENDIX D - Scientific and Technical Information Sources	39
APPENDIX E - Commercialization Fact Sheet	40

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I. PROGRAM DESCRIPTION

The Environmental Protection Agency (EPA) invites small business firms to submit research proposals under this program solicitation entitled "Small Business Innovation Research (SBIR) Program." The SBIR program is a phased process uniform throughout the Federal Government of soliciting proposals and awarding funding agreements for research (R) or research and development (R&D) to meet stated Agency needs or missions.

EPA is interested in advanced technologies in pollution prevention, air and water pollution control, solid and hazardous waste management, and environmental monitoring and analytical technologies where the research will serve as a base for technological innovation and commercialization. The proposed research must directly pertain to EPA's environmental mission and must be responsive to EPA program interests included in the topic descriptions of this solicitation.

In order to facilitate proposal reviews by external peer reviewers with specialized expertise and by EPA technical personnel with focused program needs and priorities, offerors must designate a research topic, and only one topic, for their proposal. **Only proposals indicating a single research topic by letter symbol on the cover sheet will be reviewed.** The same proposal may not be submitted under more than one topic, but an organization may submit separate proposals on different topics or different proposals on the same topic as long as the proposals are

not duplicates of the same research principle modified to fit the topic. If such duplicates are submitted, only one will be reviewed. Refer to Sections IV, V, and VII for additional requirements. Where similar research is discussed under more than one topic, the offeror should choose the topic most relevant to the proposed research. It is the complete responsibility of offerors to select and identify the best topic for their proposals.

Offerors are responsible for submitting proposals, and any modifications or revisions, so as to reach the Government office designated in this solicitation by the time specified in this solicitation. See Section VI, Paragraph J.9(c), Instructions to Offerors, concerning Late Proposals and Modifications.

This Solicitation is for Phase I only.

To stimulate and foster technological innovation, including increasing private sector applications of Federal research or R&D, EPA's program follows the SBIR program's uniform process:

PHASE I. Phase I involves a solicitation of proposals to conduct feasibility related experimental research or R&D related to described Agency requirements. The objective of this phase is to determine the technical feasibility and preliminary commercialization potential of the proposed effort and the quality of performance of the small concern with a relatively small Agency investment before consideration of further federal support in Phase II.

PHASE II. Phase II proposals may only be submitted by Phase I award winners within the same agency. Phase II is the principal research or R&D effort and should not normally exceed 24 months. Funding shall be based upon the results of Phase I and the scientific and technical merit and commercial potential of the Phase II proposal. The objective is to continue the research or R&D initiated under Phase I and work toward commercialization of the technology. Phase II proposals can only be submitted to the federal participating agency that awarded Phase I of the effort. Phase II awards may not necessarily complete the total research and development that may be required to satisfy commercial or federal needs beyond the SBIR program. Completion of the research and development may be through Phase III. The Agency is under no obligation to fund any proposal or any specific number of proposals in a given topic. It also may elect to fund several or none of the proposed approaches to the same topic or subtopic.

It is anticipated that approximately 10-15 Phase II awards with a dollar amount of \$225,000 each will be

made. For Phase II, the Agency is planning to offer a Phase II Option under which Phase II offerors may submit a proposal for \$70,000 additional funding to expand R&D efforts to accelerate commercialization. The purpose of the additional funding is to accelerate the project to the commercialization stage. EPA federal funds must be designated strictly for advancing the research related elements of the project. No automatic preference shall be given to offers which address the option; however, in the case where an offeror addresses the option in its proposal, the entire proposal including the option shall be evaluated. The Agency would have a unilateral right to exercise the option after EPA's acceptance of the company's detailed commercialization plan, including information on any commercialization funding from third party investors, such as a venture capital firm, an individual "angel" investor, bank or financial institution, or another company under a prototype testing or demonstration agreement or a partnership, licensing or joint venture agreement. The Government is not obligated to fund any specific Phase II proposal.

For technologies awarded Phase I contracts under this solicitation, the follow-on Phase II Solicitation (FY 2003) will be issued on/about October 3, 2002, and proposals will be due on/about November 19, 2002. EPA expects to allow companies submitting unsuccessful Phase II proposals to submit a revised proposal of the same technology in the next Phase II (FY 2004) Solicitation. It is expected that each Phase II proposal will be evaluated in accordance with the following criteria to determine the results of Phase I and the scientific and technical merit and commercial potential of the proposal.

PHASE II CRITERIA

1. The scientific and technical quality and significance of the proposed technology as applied R/R&D. Credibility and overall soundness of the research plan to establish the technical and commercial feasibility of the proposed concept as evidenced through technology prototypes or initial commercial demonstrations.
2. The originality, uniqueness, and ingenuity of the proposed concept as a technologically innovative and commercially viable application as evidenced through technology prototypes or initial commercial demonstrations.
3. Results of Phase I and degree to which research objectives and identified customer needs were met. Demonstration of performance/cost effectiveness and environmental benefits associated with the proposed research, including risk reduction potential.

4. Qualifications of the principal/key investigator, supporting staff, and consultants. Time commitment of principal/key investigator, adequacy of equipment and facilities, and proposed budget to accomplish the proposed research. Adequacy of Phase II Quality Assurance Summary.

5. Potential of the proposed concept for significant commercialization applications. The quality and adequacy of the commercialization plan to produce an innovative product, process, or device and getting technology prototypes or initial Phase II applications into commercial production and sales. Expected market and competition and other financial/business indicators of commercialization potential and the offeror's SBIR or other research commercialization record.

PHASE III. Where appropriate and needed in order to complete the research and development, there may be a third phase which is funded by:

1. Non-federal sources of capital for commercial applications of SBIR funded research or research and development.
2. Federal government with non-SBIR federal funds for SBIR derived products and processes that will be used by the federal government.
3. Non-SBIR federal funds for the continuation of research or research and development that has been competitively selected using peer review or scientific review criteria.

II. ELIGIBILITY

Each offeror submitting a proposal must qualify as a small business for research or R&D purposes at the time of award. In addition, the primary employment of the principal investigator must be with the small business firm at the time of award and during the conduct of the proposed research. Principal investigators who appear to be employed by a university must submit a letter from the university stating that the principal investigator, if awarded an SBIR contract, will become a less-than-half-time employee of the university. Also, a principal investigator who appears to be a staff member of both the applicant and another employer must submit a letter from the second employer stating that, if awarded an SBIR contract, he/she will become a less than half-time employee of such organization. Letters demonstrating that these requirements have been fulfilled must be

submitted prior to contract award to the addressee stated in Section VII of this solicitation. Failure to do so may jeopardize award. Also, for both Phase I and Phase II, the research or R&D work must be performed in the United States. "United States" means the 50 states, the Territories and possessions of the United States, the Commonwealth of Puerto Rico, the Trust Territory of the Pacific Islands, and the District of Columbia.

INQUIRIES. All inquiries concerning this solicitation shall be submitted to the following e-mail address:

johnson.marsha@epa.gov

If e-mail is not available to you, written or telephone inquiries may be directed to:

Marsha Johnson/SBIR-I
U.S. Environmental Protection Agency
Contracts Management Division (MD-33)
Research Triangle Park, NC 27711
(919) 541-0952

Potential offerors are encouraged to communicate via e-mail.

III. DEFINITIONS

For purposes of this solicitation, the following definitions apply:

Research or Research and Development: Any activity that is:

- (1) A systematic, intensive study directed toward greater knowledge or understanding of the subject studied.
- (2) A systematic study directed specifically toward applying new knowledge to meet a recognized need.
- (3) A systematic application of knowledge toward the production of useful materials, devices, and systems or methods, including design, development, and improvement of prototypes and new processes to meet specific requirements.

Funding Agreement: Any contract, grant, or cooperative agreement entered into between any federal agency and any small business concern for the performance of

experimental, developmental, or research work funded in whole or in part by the Federal Government.

Subcontract: Any agreement, other than one involving an employer-employee relationship, entered into by a Federal Government funding agreement awardee calling for supplies or services required solely for the performance of the original funding agreement.

Small Business Concern: A small business concern is one that, at the time of award of Phase I and Phase II funding agreements, meets the following criteria:

- (1) Is independently owned and operated, is not dominant in the field of operation in which it is proposing, has its principal place of business located in the United States, and is organized for profit;
- (2) Is at least 51 percent owned, or in the case of a publicly owned business, at least 51 percent of its voting stock is owned by United States citizens or lawfully fully admitted permanent resident aliens (if this applies, appropriate documentation must be submitted);
- (3) Has, including its affiliates, a number of employees not exceeding 500, and meets the other regulatory requirements found in 13 CFR Part 121. Business concerns, other than investment companies licensed, or state development companies qualifying under the Small Business Investment Act of 1958, 15 U.S.C. 661, et. seq., are affiliates of one another when either directly or indirectly:

- (A) one concern controls or has the power to control the other; or
- (B) a third party or parties controls or has the power to control both.

Control can be exercised through common ownership, common management, and contractual relationships. The term "affiliates" is defined in greater detail in 13 CFR 121. The term "number of employees" is defined in 13 CFR 121. Business concerns include, but are not limited to, any individual, partnership, corporation, joint venture, association, or cooperative.

Socially and Economically Disadvantaged Small Business Concern: A socially and economically disadvantaged small Business concern is one that is:

- (1) At least 51 percent owned by (i) an Indian tribe or a native Hawaiian organization, or (ii) one or more

socially and economically disadvantaged individuals, and

(2) Whose management and daily business operations are controlled by one or more socially and economically disadvantaged individuals.

Socially and Economically Disadvantaged Individual: A member of any of the following groups:

- (1) Black Americans;
- (2) Hispanic Americans;
- (3) Native Americans (American Indians, Eskimos, Aleuts, or Native Hawaiians);
- (4) Asian-Pacific Americans (persons with origins from Burma, Thailand, Malaysia, Indonesia, Singapore, Brunei, Japan, China, Taiwan, Laos, Cambodia (Kampuchea), Vietnam, Korea, The Philippines, U.S. Trust Territory of the Pacific Islands (Republic of Palau), Republic of the Marshall Islands, Federated States of Micronesia, the Commonwealth of the Northern Mariana Islands, Guam, Samoa, Macao, Hong Kong, Fiji, Tonga, Kiribati, Tuvalu, or Nauru);
- (5) Subcontinent Asian (Asian-Indian) Americans (persons with origins from India, Pakistan, Bangladesh, Sri Lanka, Bhutan, the Maldives Islands, or Nepal); and
- (6) Members of other groups designated from time to time by SBA pursuant to Section 124.103 of 13 CFR Ch.1(1-1-99 edition).

Women-Owned Small Business Concern: A small business concern that is at least 51 percent owned by a woman or women who also control and operate it. "Control" in this context means exercising the power to make policy decisions. "Operate" in this context means being actively involved in the day-to-day management.

Primary Employment: More than one-half of the principal investigator's time is spent in the employ of the small business.

United States: The 50 States, the Territories and possessions of the United States, the Commonwealth of Puerto Rico, the Trust Territory of the Pacific Islands, and the District of Columbia.

Commercialization: The process of developing markets and producing and delivering products for sale

(whether by the originating party or by others); as used here, commercialization includes both government and commercial markets.

IV. PROPOSAL PREPARATION INSTRUCTIONS AND REQUIREMENTS

A. PROPOSAL PAGE LIMIT

Proposals submitted in response to this Phase I of the SBIR program shall not exceed a total of 25 pages, one side only, except for the requirements set forth in Section IV.D.12, "Prior SBIR Awards". Pages should be of standard size (8 1/2" x 11"; 21.6 cm x 27.9 cm) with 2.5 cm margins and type no smaller than 10 point font size. All pages must be consecutively numbered. Proposals in excess of the page limitation shall not be considered for review or award. A letter of transmittal is not necessary. If one is furnished, it must not be attached to every copy of the proposal. If a letter of transmittal is attached to every copy of the proposal, it will be counted as page 1 of the proposal. No binders are necessary. If binders are provided, they will be counted as pages even if no printing or writing is thereon.

B. PROPOSAL COVER SHEET

The offeror shall photocopy (or download from the Internet) and complete Appendix A as page 1 of each copy of each proposal. **No other cover is permitted.** When downloading the solicitation from the Internet, Appendix A may print on two pages, but will only count as one page per Appendix. Offerors may reformat the forms to correct spacing and pagination errors, however, identical information must be provided.

The original of the cover sheet must contain the pen-and-ink signatures of the authorized negotiator and the person authorized to sign the proposal.

C. ABSTRACT OR SUMMARY

The offeror shall complete Appendix B as page 2 of each proposal. Appendix B is limited to 1 page. The technical abstract should include a brief description of the problem or opportunity, the innovation, project objectives, and description of the effort. In summarizing anticipated results, the implications of the approach (for both Phases I and II) and the potential commercial applications of the

research shall be stated. **THE ABSTRACT IS USED EXTENSIVELY DURING THE EXTERNAL PEER REVIEW AND EPA INTERNAL RELEVANCY REVIEW.** The project summary of successful proposals will be published by EPA and, therefore, must not contain proprietary information.

D. TECHNICAL CONTENT

Begin the main body of the proposal on page 3. As a minimum, the following shall be included:

1. IDENTIFICATION AND SIGNIFICANCE OF THE PROBLEM OR OPPORTUNITY. A clear statement of the specific technical problem or opportunity addressed and the environmental benefits. **INFORMATION ON THE ENVIRONMENTAL BENEFITS ASSOCIATED WITH THE TECHNOLOGY IS A VERY IMPORTANT PART OF THE EXTERNAL PEER REVIEW AND EPA INTERNAL RELEVANCY REVIEW.**

2. PHASE I TECHNICAL OBJECTIVES. State the specific objectives of the Phase I research and development effort, including the technical questions it will try to answer to determine the feasibility of the proposed approach.

3. PHASE I WORK PLAN. A detailed description of the Phase I R/R&D plan. The plan should indicate what will be done, where it will be done and how the R/R&D will be carried out. The work planned to achieve each objective or task should be discussed in detail, to enable a complete scientific and technical evaluation of the work plan. A work schedule also should be provided.

4. RELATED RESEARCH OR R&D. Describe significant research or R&D that is directly related to the proposal including any conducted by the project manager/principal investigator or by the proposing firm. Describe how it relates to the proposed effort, and any planned coordination with outside sources. Offerors must demonstrate their awareness of key recent research or R&D conducted by others in the specific topic area by providing appropriate references from the literature and other published documents.

5. KEY PERSONNEL AND BIBLIOGRAPHY OF DIRECTLY RELATED WORK. Identify key personnel involved in Phase I including their directly related education, experience, and bibliographic information. Where vitae are extensive, summaries

that focus on the most relevant experience or publications are desired and may be necessary to meet proposal size limitations.

6. RELATIONSHIP WITH FUTURE RESEARCH OR RESEARCH AND DEVELOPMENT. State the anticipated results of the proposed approach if the project is successful (Phase I and II). A discussion of cost-effectiveness is paramount, especially comparing the state-of-the-art approaches with the proposed approach. Discuss the significance of the Phase I effort in providing a foundation for Phase II R/R&D effort.

7. FACILITIES. A detailed description, availability and location of instrumentation and physical facilities proposed for Phase I should be provided.

8. CONSULTANTS. Involvement of consultants in the planning and research stages of the project is permitted. If such involvement is intended, it should be described in detail and vitae should be provided.

9. COMMERCIALIZATION PLAN. Provide an abbreviated 2-3 page plan related directly to producing an innovative product, process, or device and getting it into commercial production and sales. Comprehensive business plans (that are company rather than project oriented) are not desired. The Phase I plan is a roadmap toward producing a detailed Phase II Commercialization Plan, which will be required as part of the Phase II Application.

NOTE: The Small Business Research and Development Enhancement Act of 1992 allows discretionary technical assistance to SBIR awardees. The Agency may provide up to \$4,000 of SBIR funds for technical assistance per award. EPA intends to provide Phase I awardees with technical assistance through a separate EPA arrangement. For Phase I, this assistance will be in addition to the award amount. For Phase II, the law allows each awardee to expend up to \$4,000 per year of the award amount for technical assistance services.

The Phase I plan should provide limited information on the subjects described below. Explain what will be done during Phase I to decide on applications, markets, production, and financing. The Commercialization Plan should address:

- a. SBIR Project: Brief description of the company, its principal field(s) of interest, size, and current products and sales. A concise description

of the SBIR project and its key technical objectives.

b. Commercial Applications: Potential commercial applications of the research results specifying customers and specific needs that will be satisfied. Do you have or intend to file for one or more patents as a result of the SBIR project?

c. Competitive Advantages: What is particularly innovative about the anticipated technology or products? (Innovation may be expressed in terms of applications, performance, efficiencies, or reduced cost. To determine if your innovation is likely to result in intellectual property that may be legally protected, it helps to conduct a patent search and look for related work being funded by EPA or another federal agency. A fact sheet on how to search for patents and related federally-funded work is provided in Appendix E.) What significant advantages in application, performance, technique, efficiency, or costs, do you anticipate your new technology will have over existing technology? (In order to assess such advantages, it is useful to compare the anticipated performance of your technology against substitutable products currently being sold or emerging out of R&D. If regulations, industry standards, or certifying requirements apply to your technology or product, these provide useful criteria for comparing your anticipated performance with potentially competing technology and products. However, other expressions of end-user needs also may contain important criteria.)

d. Markets: What are the anticipated specific markets for the resulting technology, their estimated size, classes of customers, and your estimated market share 5 years after the project is completed and/or first sales? Who are the major competitors in the markets, present and/or anticipated?

e. Commercialization: Briefly describe how you plan to produce your product. Do you intend to manufacture it yourself, subcontract the manufacturing, enter into a joint venture or manufacturing agreement, license the product, etc.? Briefly describe the approach and steps you plan to take to commercialize the research results to significant sales. Do you plan to market the product yourself, through dealers, contract sales, marketing agreements, joint venture, sales representatives, foreign

companies, etc.? How do you plan to raise money to support your commercialization plan?

10. SIMILAR OR CLOSELY RELATED SBIR AWARDS. If the small business concern has received ANY prior Phase I or Phase II award(s) from EPA or any federal agency for similar or closely related research, submit name of awarding agency, date of award, funding agreement number, amount, topic or subtopic title, follow-on agreement amount, source and date of commitment, and current commercialization status. **DESCRIBE THE TECHNICAL DIFFERENCES AND REASONS WHY THE PROPOSED NEW PHASE I RESEARCH IS DIFFERENT FROM RESEARCH CONDUCTED UNDER PRIOR SBIR AWARDS.** (This required proposal information shall be counted toward proposal pages count limitation.)

11. DUPLICATE OR EQUIVALENT SBIR PROPOSALS. A firm may elect to submit essentially equivalent work under other federal program solicitations. In these cases, a statement must be included in each such proposal indicating: the name and address of the agencies to which proposals were submitted or from which awards were received; date of proposal submission or date of award; title, number, and date of solicitations under which proposals were submitted or awards received; specific applicable research topics for each proposal submitted or award received; titles of research projects; and name and title of project manager or principal investigator for each proposal submitted or award received. (This information shall be counted toward proposal pages count limitation.)

12. PRIOR SBIR AWARDS. If the small business concern has received ANY prior Phase II award from any federal agency in the prior 5 fiscal years, submit name of awarding agency, date of award, funding agreement number, amount, topic or subtopic title, follow-on agreement amount, source and date of commitment, and current commercialization status for each Phase II. (This required proposal information shall be included as an attachment to the proposals and shall not be counted toward proposal pages count limitation.)

E. COST BREAKDOWN/ PROPOSED BUDGET

Complete the budget form in Appendix C and include the form immediately after proposal Section D.11.

Photocopy the form for the required copies for submission. Incorporate the copy of the budget form bearing the original signature into the copy of the proposal bearing the original signature on the cover page. The budget form will count as one page in the 25 page limit. If budget explanation pages are included, they will count toward the 25 page limit.

F. PHASE I QUALITY ASSURANCE NARRATIVE STATEMENT

Offerors must state whether or not their proposal involves the performance of environmental technology, whether hardware-based or via new techniques. This quality assurance narrative statement should not exceed 2 pages and will be included in the 25 page limitation for the proposal. The narrative statement must, for each of the following items, either address the required information or explain why the item does not apply to the proposed research.

1. Discuss the activities to be performed or hypothesis to be tested and criteria for determining acceptable data quality. (Note: Such criteria may be expressed in terms of precision, accuracy, representativeness, completeness, and comparability. These criteria must also be applied to determine the acceptability of existing or secondary data to be used in the project.)
2. Describe the study design, including sample type and location requirements, any statistical analyses that were used to estimate the types and numbers of samples required for physical samples, or equivalent information for studies using survey and interview techniques.
3. Describe the procedures for the handling and custody of samples, including sample collection, identification, preservation, transportation, and storage.
4. Describe the procedures that will be used in the calibration and performance evaluation of the sampling and analytical methods and equipment to be used during the project.
5. Discuss the procedures for data reduction and reporting, including a description of statistical analyses to be used and of any computer models to be designed or utilized with associated verification and validation techniques.

6. Describe the quantitative and/or qualitative procedures that will be used to evaluate the success of the project, including any plans for peer or other reviews of the study design or analytical methods prior to data collection.

A more detailed Proposal Quality Assurance Plan will be required in Phase II. The plan will be required as part of the first monthly report under the Phase II contract.

V. METHOD OF SELECTION AND EVALUATION CRITERIA

All Phase I proposals will be evaluated and judged on a competitive basis by peer reviewers from outside EPA. Proposals will be initially screened to determine responsiveness. As noted in Section IV, proposals exceeding the 25-page limitation will not be considered for review or award. Also, as noted in Section I, any proposal addressing more than one research topic, or failing to identify the research topic by letter symbol on the cover page, will not be considered for review or award. Proposals passing this initial screening will be reviewed for technical merit by external peer panels of technical experts, using the technical evaluation criteria described in A.1 below. Each of the criteria are equal in value. These panels will assign each proposal an adjectival rating of “excellent”, “very good”, “good”, “fair” or “poor”, using the specified criteria. The proposals assigned “excellent” and “very good” ratings, will then be subjected to the relevancy review within EPA, to further evaluate these applications in relation to program priorities and balance using the criteria specified in A.2 below. Each proposal will be judged on its own merit. The Agency is under no obligation to fund any proposal or any specific number of proposals in a given topic. It also may elect to fund several or none of the proposed approaches to the same topic or subtopic.

A. TECHNICAL EVALUATION CRITERIA

1. EXTERNAL PEER REVIEW. The external peer review panels will utilize the following evaluation criteria to rate each proposal. The criteria are of equal importance.

CRITERIA

- a. The scientific and technical significance of the proposed technology and its appropriateness to the research topic. Quality and soundness of the research plan to establish the technical and commercial feasibility of the concept.
- b. The uniqueness/ingenuity of the proposed concept or application as technological innovation. Originality and innovativeness of the proposed research toward meeting customer needs and achieving commercialization of the technology.
- c. Potential demonstration of performance/cost effectiveness and environmental benefits associated with the proposed research, including risk reduction potential.
- d. Qualifications of the principal/key investigator, supporting staff, and consultants. Time commitment of principal/key investigator, adequacy of equipment and facilities, and proposed budget to accomplish the proposed research. Adequacy and quality of the Quality Assurance Narrative Statement.
- e. Potential of the proposed concept for significant commercial applications. Potential for the commercialization plan to produce an innovative product, process, or device and getting it into commercial production and sales. Potential market and competition and other financial/business indicators of commercialization potential and the offeror's SBIR or other research commercialization record.

All peer reviewers will be required to sign an agreement to protect the confidentiality of all proposal material, and to certify that no conflict of interest exists between the reviewer and the offeror. A copy of both forms is available upon request; however, the identity of the reviewer will not be released.

2. EPA RELEVANCY REVIEW. The proposals that received ratings of "Excellent" or "Very Good" by the External Peer Review Panel will be subject to the relevancy review by EPA program managers using the criteria set forth below to select which of the "Excellent" and "Very Good" proposals will be funded. Projects will not be funded where EPA determines the proposed research already is being supported by EPA or another known source. The evaluation criteria "a"

through "c" are of equal value and will be used to evaluate the applications in relation to program priorities, balance, and relevancy.

CRITERIA

- a. The potential of the technology to meet Agency program priorities and to strengthen the overall balance of the SBIR program. How well the technology fits into EPA's overall research strategy.
- b. The potential of the technology for significant environmental benefits and for strengthening the scientific basis for risk assessment/risk management in the Agency research topic area.
- c. The potential of the technology to have broad application or to impact large segments of the population.

B. RELEASE OF PROPOSAL REVIEW INFORMATION

After final award decisions have been announced, the technical evaluations of the offeror's proposal will be provided to the offeror. The identity of the reviewer shall not be disclosed.

VI. CONSIDERATIONS**A. AWARDS**

EPA anticipates award of approximately 40 firm-fixed-price contracts of up to \$70,000 each including profit. It is expected that these contracts will be awarded with a contract start date of March 29, 2002. The period of performance for the contracts should not normally exceed six (6) months except where Agency needs or research plans require otherwise. Exceptions should be minimized. The primary consideration in selecting proposals for award will be the technical merit of the proposal. Proposals shall be evaluated in accordance with the Technical Evaluation Criteria stated in V.A. above. Source selection will not be based on a comparison of cost or price. However, cost or price will be evaluated to determine whether the price, including any proposed profit, is fair and reasonable and whether the offeror understands the work and is capable of performing the contract.

This current solicitation is for Phase I only, and the Government is not obligated to fund any specific Phase I proposal.

Funds are not presently available for this contract. The Government's obligation under this contract is contingent upon the availability of appropriated funds from which payment for contract purposes can be made. No legal liability on the part of the Government for any payment may arise until funds are made available to the Contracting Officer for this contract and until the Contractor receives notice of such availability, to be confirmed in writing by the Contracting Officer.

B. REPORTS

1. The Contractor shall furnish two (2) copies of a monthly letter report stating progress made. One (1) copy of the report shall be submitted to the Project Officer and one (1) copy to the Contracting Officer. The reports shall be submitted within 7 calendar days after the end of the reporting period. Specific areas of interest shall include progress made and difficulties encountered during the reporting period, and a statement of activity anticipated during the subsequent reporting period. The report shall include any changes in personnel associated with the project. Also, the first month's report shall contain a work plan and schedule of accomplishments for the subsequent months of the project. The monthly report shall include, as an attachment, a copy of the monthly voucher for the same period.

2. Two (2) copies of a comprehensive final report on the Phase I project must be submitted to the Project Officer by the completion date of the contract. The Contracting Officer shall receive one copy. This final report shall include a single-page project summary as the first page, identifying the purpose of the research, a brief description of the research carried out, the research findings or results, and potential applications of the research in a final paragraph. The balance of the report should indicate in detail the research objectives, research work carried out, results obtained, and estimates of technical feasibility. The report should include a discussion of any commercialization activities carried out during Phase I as well as future commercialization plans. The final report will be required as part of the Phase II proposal submitted in response to the Phase II solicitation.

3. Two (2) hard copies (and one copy on a disk in WordPerfect or ASCII format) of a publishable (cleared for the general public) 2-3 page Executive

Summary of the final report for Phase I must be submitted to the Project Officer by the completion date of the contract. This special report should be a true summary of the report, including the purpose of the project, work carried out, and results. The summary should stress innovativeness and potential commercialization. The Executive Summary will be placed on the EPA SBIR Website, and therefore, it should include the specific results the company is willing to release to the public.

C. PAYMENT SCHEDULE

Phase I payments will be made as follows:

Eighteen percent (18%) of the total contract price upon receipt and acceptance of a proper invoice with each of the first five monthly reports. The remainder shall be paid upon receipt and acceptance of the final report. Pursuant to the provisions of FAR 52.232-25, "Prompt Payment", payment will be rendered within thirty (30) days after receipt of a proper invoice.

D. INNOVATIONS, INVENTIONS, AND PATENTS

1. LIMITED RIGHTS INFORMATION AND DATA

a. Proprietary Information

Information contained in unsuccessful proposals will remain the property of the offeror. The Government may, however, retain copies of all proposals. Public release of information in any proposal submitted will be subject to existing statutory and regulatory requirements.

If proprietary information is provided by an offeror in a proposal which constitutes a trade secret, proprietary commercial or financial information, confidential personal information, or data affecting the national security, it will be treated in confidence to the extent permitted by law, provided this information is clearly marked by the offeror with the term "confidential proprietary information" and provided the following legend appears on the title page of the proposal:

"For any purpose other than to evaluate the proposal, this data shall not be disclosed outside the Government and shall not be duplicated, used, or disclosed in whole or in part, provided that if a

funding agreement is awarded to this offeror as a result of or in connection with the submission of this data, the Government shall have the right to duplicate, use, or disclose the data to the extent provided in the funding agreement. This restriction does not limit the Government's right to use information contained in the data if it is obtained from another source without restriction. The data subject to this restriction is contained in pages _____ of this proposal."

Any other legend may be unacceptable to the Government and may constitute grounds for removing the proposal from further consideration and without assuming any liability for inadvertent disclosure.

b. Alternative to Minimize Proprietary Information: Offerors shall limit proprietary information to only that absolutely essential to their proposal.

c. Rights in Data Developed Under SBIR Funding Agreements: The contract will contain a data clause which will provide the following:

SBIR RIGHTS NOTICE (MAR 1994)

These SBIR data are furnished with SBIR rights under Contract No. _____ (and subcontract _____ if appropriate). For a period of four (4) years after acceptance of all items to be delivered under this contract, the Government agrees to use these data for Government purposes only, and they shall not be disclosed outside the Government (including disclosure for procurement purposes) during such period without permission of the Contractor, except that, subject to the foregoing use and disclosure prohibitions, such data may be disclosed for use by support Contractors. After the aforesaid 4-year period, the Government has a royalty-free license to use, and to authorize others to use on its behalf, these data for Government purposes, but is relieved of all disclosure prohibitions and assumes no liability for unauthorized use of these data by third parties. This Notice shall be affixed to any reproductions of these data, in whole or in part.

d. Copyrights

With prior written permission of the Contracting Officer, the Awardee normally may copyright and publish (consistent with appropriate national security considerations, if any) material developed

with EPA support. EPA receives a royalty-free license for the Federal Government and requires that each publication contain an appropriate acknowledgment and disclaimer statement.

e. Patents

Small business concerns normally may retain the principal worldwide patent rights to any invention developed with Governmental support. The Government receives a royalty-free license for Federal Government use, reserves the right to require the patent holder to license others in certain circumstances, and requires that anyone exclusively licensed to sell the invention in the United States must normally manufacture it domestically. To the extent authorized by 35 U.S.C. 205, the Government will not make public any information disclosing a Government-supported invention for a 4-year period to allow the Awardee a reasonable time to pursue a patent.

E. COST SHARING

Cost sharing is permitted for proposals under this Program Solicitation; however, cost sharing is not required nor will it be an evaluation factor in consideration of your proposal.

F. FEE OR PROFIT

Reasonable fee (estimated profit) will be considered under this solicitation. For guidance purposes, the amount of profit normally should not exceed 10% of total project costs.

G. JOINT VENTURES OR LIMITED PARTNERSHIPS

Joint ventures and limited partnerships are eligible provided the entity created qualifies as a small business as defined in this Program Solicitation.

H. RESEARCH AND ANALYTICAL WORK

1. For Phase I, a minimum of two-thirds of the research and/or analytical effort must be performed by the proposing small business concern unless otherwise approved in writing by the Contracting Officer.

2. For Phase II, a minimum of one-half of the research and/or analytical effort must be performed by

the proposing small business concern unless otherwise approved in writing by the Contracting Officer.

I. CONTRACTOR COMMITMENTS

Upon award of a funding agreement, the Awardee will be required to make certain legal commitments through acceptance of numerous clauses in Phase I funding agreements. The outline that follows is illustrative of the types of clauses to which the Contractor would be committed. This list should not be understood to represent a complete list of clauses to be included in Phase I funding agreements, nor to be specific wording of such clauses. Copies of complete terms and conditions are available upon request.

1. INSPECTION. Work performed under the contract is subject to Government inspection and evaluation at all times.

2. EXAMINATION OF RECORDS. The Comptroller General (or a duly authorized representative) shall have the right to examine any directly pertinent records of the awardee involving transactions related to this contract.

3. DEFAULT. The Government may terminate the contract if the Contractor fails to perform the work contracted.

4. TERMINATION FOR CONVENIENCE. The contract may be terminated at any time by the Government if it deems termination to be in its best interest, in which case the Contractor will be compensated for work performed and for reasonable termination costs.

5. DISPUTES. Any dispute concerning the funding agreement that cannot be resolved by agreement shall be decided by the Contracting Officer with right of appeal.

6. EQUAL OPPORTUNITY. The awardee will not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin.

7. AFFIRMATIVE ACTION FOR VETERANS. The awardee will not discriminate against any employee or application for employment because he or she is a disabled veteran or veteran of the Vietnam era.

8. AFFIRMATIVE ACTION FOR HANDICAPPED. The awardee will not discriminate against any employee or applicant for employment because he or she is physically or mentally handicapped.

9. OFFICIALS NOT TO BENEFIT. No Government official shall benefit personally from the contract.

10. COVENANT AGAINST CONTINGENT FEES. No person or agency has been employed to solicit or secure the contract upon an understanding for compensation except bonafide employees or commercial agencies maintained by the Contractor for the purpose of securing business.

11. GRATUITIES. The contract may be terminated by the Government if any gratuities have been offered to any representative of the Government to secure the contract.

12. PATENT AND COPYRIGHT INFRINGEMENT. The Contractor shall report each notice or claim of patent or copyright infringement based on the performance of the contract.

13. AMERICAN MADE EQUIPMENT AND PRODUCTS. When purchasing equipment or a product under the SBIR funding agreement, purchase only American-made items whenever possible.

J. ADDITIONAL INFORMATION

1. The Program Solicitation is intended for informational purposes and reflects current planning. If there is any inconsistency between the information contained herein and the terms of any resulting SBIR funding agreement, the terms of the funding agreement are controlling.

2. Before award of an SBIR funding agreement, the Government may request the offeror to submit certain organizational, management, personnel, and financial information to assure responsibility of the offeror.

3. The Government is not responsible for any monies expended by the offeror before award of any funding agreement.

4. This Program Solicitation is not an offer by the Government and does not obligate the Government to make any specific number of awards. Also, awards

under the SBIR program are contingent upon the availability of funds.

5. The SBIR program is not a substitute for existing unsolicited proposal mechanisms. Unsolicited proposals shall not be accepted under the SBIR program in either Phase I or Phase II.

6. If an award is made pursuant to a proposal submitted under this Program Solicitation, the Contractor will be required to certify that he or she has not previously been, nor is currently being, paid for essentially equivalent work by any agency of the Federal Government.

7. Notwithstanding the relatively broad definition of R/R&D in Section III, Definitions, hereof, awards under this solicitation are limited to APPLIED forms of research. Proposals that are surveys, including market, state-of-the-art, and/or literature surveys, which should have been performed by the offeror prior to the preparation of the proposal, or the preparation of allied questionnaires and instruction manuals, shall not be accepted. If such proposals are submitted, they shall be considered as not in compliance with the solicitation intent, and therefore, technically unacceptable.

8. The requirement that the offeror designate a topic, and only one topic, (see page 1, Section I above) is also necessary. EPA receives hundreds of proposals each year and has special teams of reviewers for review of each research topic. In order to assure that proposals are evaluated by the correct team, it is the complete responsibility of the offeror to select and identify the best topic.

9. Instructions to Offerors - Competitive Acquisition (Feb 2000) FAR 52.215-1

(a) *Definitions.* As used in this provision, discussions are negotiations that occur after establishment of the competitive range that may, at the Contracting Officer's discretion, result in the offeror being allowed to revise its proposal.

In writing or written means any worded or numbered expression which can be read, reproduced, and later communicated, and includes electronically transmitted and stored information.

Proposal modification is a change made to a proposal before the solicitation's closing date and time, or made in response to an amendment, or

made to correct a mistake at any time before award.

Proposal revision is a change to a proposal made after the solicitation closing date, at the request of or as allowed by a Contracting Officer as the result of negotiations.

Time, if stated as a number of days, is calculated using calendar days, unless otherwise specified, and will include Saturdays, Sundays, and legal holidays. However, if the last day falls on a Saturday, Sunday, or legal holiday, then the period shall include the next working day.

(b) *Amendments to solicitations.* If this solicitation is amended, all terms and conditions that are not amended remain unchanged. Offerors shall acknowledge receipt of any amendment to this solicitation by the date and time specified in the amendment(s).

(c) *Submission, modification, revision, and withdrawal of proposals.* (1) Unless other methods (e.g., electronic commerce or facsimile) are permitted in the solicitation, proposals and modifications to proposals shall be submitted in paper media in sealed envelopes or packages (i) addressed to the office specified in the solicitation, and (ii) showing the time and date specified for receipt, the solicitation number, and the name and address of the offeror. Offerors using commercial carriers should ensure that the proposal is marked on the outermost wrapper with the information in paragraphs (c)(1)(i) and (c)(1)(ii) of this provision.

(2) The first page of the proposal must show—

(i) The solicitation number;

(ii) The name, address, and telephone and facsimile numbers of the offeror (and electronic address if available);

(iii) A statement specifying the extent of agreement with all terms, conditions, and provisions included in the solicitation and agreement to furnish any or all items upon which prices are offered at the price set opposite each item;

(iv) Names, titles, and telephone and facsimile numbers (and electronic addresses if available) of persons authorized to negotiate

on the offeror's behalf with the Government in connection with this solicitation; and

(v) Name, title, and signature of person authorized to sign the proposal. Proposals signed by an agent shall be accompanied by evidence of that agent's authority, unless that evidence has been previously furnished to the issuing office.

(3) *Submission, modification, revision, and withdrawal of proposals.*

(i) Offerors are responsible for submitting proposals, and any modifications or revisions so as to reach the Government office designated in the solicitation by the time specified in the solicitation. If no time is specified in the solicitation, the time for receipt is 4:30 p.m., local time, for the designated Government office on the date that proposal or revision is due.

(ii)(A) Any proposal, modification, or revision received at the Government office designated in the solicitation after the exact time specified for receipt of offers is "late" and will not be considered unless it is received before award is made, the Contracting Officer determines that accepting the late offer would not unduly delay the acquisition; and—

(1) If it was transmitted through an electronic commerce method authorized by the solicitation, it was received at the initial point of entry to the Government infrastructure not later than 5:00 p.m. one working day prior to the date specified for receipt of proposals; or

(2) There is acceptable evidence to establish that it was received at the Government installation designated for receipt of offers and was under the Government's control prior to the time set for receipt of offers; or

(3) It is the only proposal received.

(B) However, a late modification of an otherwise successful proposal that makes its terms more favorable to the Government, will be considered at any time it is received and may be accepted.

(iii) Acceptable evidence to establish the time of receipt at the Government installation includes the time/date stamp of that installation on the proposal wrapper, other documentary evidence of receipt maintained by the installation, or oral testimony or statements of Government personnel.

(iv) If an emergency or unanticipated event interrupts normal Government processes so that proposals cannot be received at the office designated for receipt of proposals by the exact time specified in the solicitation, and urgent Government requirements preclude amendment of the solicitation, the time specified for receipt of proposals will be deemed to be extended to the same time of day specified in the solicitation on the first work day on which normal Government processes resume.

(v) Proposals may be withdrawn by written notice received at any time before award. Oral proposals in response to oral solicitations may be withdrawn orally. If the solicitation authorizes facsimile proposals, proposals may be withdrawn via facsimile received at any time before award, subject to the conditions specified in the provision at 52.215-5, Facsimile Proposals. Proposals may be withdrawn in person by an offeror or an authorized representative, if the identity of the person requesting withdrawal is established and the person signs a receipt for the proposal before award.

(4) Unless otherwise specified in the solicitation, the offeror may propose to provide any item or combination of items.

(5) Offerors shall submit proposals in response to this solicitation in English, unless otherwise permitted by the solicitation, and in U.S. dollars, unless the provision at FAR 52.225-17, Evaluation of Foreign Currency Offers, is included in the solicitation.

(6) Offerors may submit modifications to their proposals at any time before the solicitation closing date and time, and may submit modifications in response to an amendment, or to correct a mistake at any time before award.

(7) Offerors may submit revised proposals only if requested or allowed by the Contracting Officer.

(8) Proposals may be withdrawn at any time before award. Withdrawals are effective upon receipt of notice by the Contracting Officer.

(d) *Offer expiration date.* Proposals in response to this solicitation will be valid for the number of days specified on the solicitation cover sheet (unless a different period is proposed by the offeror).

(e) *Restriction on disclosure and use of data.* Offerors that include in their proposals data that they do not want disclosed to the public for any purpose, or used by the Government except for evaluation purposes, shall—

(1) Mark the title page with the following legend: This proposal includes data that shall not be disclosed outside the Government and shall not be duplicated, used, or disclosed—in whole or in part—for any purpose other than to evaluate this proposal. If, however, a contract is awarded to this offeror as a result of—or in connection with—the submission of this data, the Government shall have the right to duplicate, use, or disclose the data to the extent provided in the resulting contract. This restriction does not limit the Government's right to use information contained in this data if it is obtained from another source without restriction. The data subject to this restriction are contained in sheets [insert numbers or other identification of sheets]; and

(2) Mark each sheet of data it wishes to restrict with the following legend: Use or disclosure of data contained on this sheet is subject to the restriction on the title page of this proposal.

(f) *Contract award.*

(1) The Government intends to award a contract or contracts resulting from this solicitation to the responsible offeror(s) whose proposal(s) represents the best value after evaluation in accordance with the factors and subfactors in the solicitation.

(2) The Government may reject any or all proposals if such action is in the Government's interest.

(3) The Government may waive informalities and minor irregularities in proposals received.

(4) The Government intends to evaluate proposals and award a contract without discussions with

offerors (except clarifications as described in FAR 15.306(a)). Therefore, the offeror's initial proposal should contain the offeror's best terms from a cost or price and technical standpoint. The Government reserves the right to conduct discussions if the Contracting Officer later determines them to be necessary. If the Contracting Officer determines that the number of proposals that would otherwise be in the competitive range exceeds the number at which an efficient competition can be conducted, the Contracting Officer may limit the number of proposals in the competitive range to the greatest number that will permit an efficient competition among the most highly rated proposals.

(5) The Government reserves the right to make an award on any item for a quantity less than the quantity offered, at the unit cost or prices offered, unless the offeror specifies otherwise in the proposal.

(6) The Government reserves the right to make multiple awards if, after considering the additional administrative costs, it is in the Government's best interest to do so.

(7) Exchanges with offerors after receipt of a proposal do not constitute a rejection or counter-offer by the Government.

(8) The Government may determine that a proposal is unacceptable if the prices proposed are materially unbalanced between line items or sub-line items. Unbalanced pricing exists when, despite an acceptable total evaluated price, the price of one or more contract line items is significantly overstated or understated as indicated by the application of cost or price analysis techniques. A proposal may be rejected if the Contracting Officer determines that the lack of balance poses an unacceptable risk to the Government.

(9) If a cost realism analysis is performed, cost realism may be considered by the source selection authority in evaluating performance or schedule risk.

(10) A written award or acceptance of proposal mailed or otherwise furnished to the successful offeror within the time specified in the proposal shall result in a binding contract without further action by either party.

(11) The Government may disclose the following information in postaward debriefings to other offerors:

- (i) The overall evaluated cost or price and technical rating of the successful offeror;
- (ii) The overall ranking of all offerors, when any ranking was developed by the Agency during source selection;
- (iii) A summary of the rationale for award; and
- (iv) For acquisitions of commercial items, the make and model of the item to be delivered by the successful offeror.

VII. SUBMISSION OF PROPOSALS

A. Your proposal with an original and nine (9) copies shall be received at one of the following addresses by 4:30 p.m., local time, on May 24, 2001.

U.S. MAIL ADDRESS:

U.S. Environmental Protection Agency
Solicitation No. PR-NC-01-11782 ; SBIR Phase I
Closing Date: May 24, 2001 at 4:30 p.m.
Contracts Management Division (MD-33)
Attn: Marsha Johnson
Research Triangle Park, NC 27711

HAND CARRIED/COURIER ADDRESS:

U.S. Environmental Protection Agency
Receptionist, EPA Administration Building
Solicitation No. PR-NC-01-11782 ; SBIR Phase I
Closing Date: May 24, 2001 at 4:30 p.m.
Attn: Marsha Johnson/Contracts Mgmt. Division
79 T.W. Alexander Drive
Research Triangle Park, NC 27709

IMPORTANT!!! Please note Section VI, Paragraph J.9(c) concerning Late Proposals, Modifications of Proposals, and Withdrawal of Proposals.

Telegraphic, telecopied, or facsimile proposals will NOT be considered for award.

B. Please do not use special bindings or covers. Staple the pages in the upper left corner of the cover sheet of each proposal.

C. All copies of a proposal shall be sent in the same package.

D. The proposal should be self-contained and written with the care and thoughtfulness accorded papers for publication.

VIII. SCIENTIFIC AND TECHNICAL INFORMATION SOURCES

(See Appendix D)

IX. FY2002 SBIR PHASE I RESEARCH TOPICS

Program Scope: The objective of this solicitation is to increase the incentive and opportunity for small firms to undertake cutting edge, high-risk, or long-term research that has a high potential payoff if the research is successful. Federal support of the front-end research on new ideas, often the highest risk part of the innovation process, may provide small businesses sufficient incentive to pursue such research.

EPA's SBIR program does not fund basic research or literature searches. It is recognized that any research and development project starts out as a concept of the inventor. Basic theoretic research studies and preliminary laboratory testing of the concept are often needed to develop an idea. Literature and other surveys and questionnaires also are needed to rule out duplication and inappropriate research study and process detail, finally leading to the process design of a prototype apparatus or process that could be tested to show the feasibility of the innovation. These basic research activities and preliminary studies should be completed before preparing an SBIR proposal.

Proposals only offering computer expert systems, computer models, and computer aided design activities are unacceptable. Computer activities may be helpful tools in the early identification of pollution problems and possible solutions, but they do not directly reduce pollution. They

cannot be used in lieu of applied laboratory research to determine the feasibility of a pollution control process. Also, proposals that only offer the performance of a design activity cannot be judged as it is impossible to guess what sort of apparatus or process will result. Without a straightforward description of the process and/or apparatus to be tested, there can be no determination of the scientific and technical quality of the work plan. Proposals only offering such design activities are unacceptable.

Program Topics: The proposed research must directly pertain to EPA's environmental mission and must be responsive to EPA program interests included in the topic descriptions of this solicitation. The research should be the basis for technological innovation resulting in new commercial products, processes, or services which benefit the public and promote the growth of the small business. The Agency's SBIR program is concerned with air and water pollution control, solid and hazardous waste management, nanomaterials and clean technology, and environmental monitoring and analytical technologies. In order to facilitate proposal reviews by external peer reviewers with specialized expertise and by EPA technical personnel with focused program needs and priorities, offerors must designate a research topic, and only one topic, for their proposal. It is the complete responsibility of the offeror to select and identify the best topic for the proposal.

Technologies featuring conservation, reuse, recycling, increased efficiencies, waste minimization, and nanotechnologies are of special interest. Processes involving anthropogenic radioactive materials or the application of fertilizers are addressed by other agencies and are not included in this Solicitation. Technologies that only involve energy efficiency, where the pollution reduction benefit is indirect reduction of power plant emissions, are also addressed by other agencies and are not included in this Solicitation. Specific topics of this Solicitation include:

A. NANOMATERIALS AND CLEAN TECHNOLOGY

Research is needed to apply the principles of nanotechnology to the areas of environmental monitoring and pollution control. Nanotechnology is defined as the creation of functional materials, devices, and systems through control of matter at the scale of 1 to 100 nanometers, and the exploitation of novel properties and phenomena at the same scale. Nanotechnology is emerging as a field critical for enabling essential breakthroughs that may have tremendous potential for affecting several environmental areas. Moreover, nanotechnologies developed

in the next several years may well form the foundation of significant commercial platforms. This nanomaterials topic area is closely related to other topics in the Solicitation. Specific areas of interest include, but are not limited to:

- Development of nanoporous filters for removal of gaseous pollutants and particulates from contaminated air streams.
- Development of nanofiltration membranes for organic solvent recovery and similar applications.
- Development of nanoparticulate catalysts for utilization in VOC treatment devices and related applications.
- Development of microelectromechanical systems (MEMS) and nanotechnology based devices for use in environmental analytical and monitoring instrument devices including sensors and nano plumbing components.
- Development of hazardous metal free nano laminated pigments and coatings.
- Development of technology for solvent-free production of nano-size high-performance ceramic powders and similar materials.
- Development of coatings and high surface area nano materials for environmental applications.
- Technology for the synthesis, assembly, and processing of nano structured materials and devices for environmental applications.

Clean Technology, the second part of this topic, is an umbrella term which includes in whole or in part the following other commonly-used terms to denote environmental-conscious industrial practices: pollution prevention, waste minimization, and green chemistry. While various meanings have been ascribed to these terms, depending upon the specific context in which they are used, for the purposes of this topic, all three terms refer to technologies designed to reduce or eliminate the use of substances that are hazardous to human health and the environment, or to reduce the generation of wastes, including fugitive emissions, that are similarly hazardous. While improvements in house keeping, maintenance, training or inventory control might well serve to reduce or prevent pollution (or minimize the generation of waste), these activities are outside the scope of EPA's SBIR Program.

Examples of pollution prevention, waste minimization, and green chemistry areas of interest include, but are not limited to:

- In-Process Recycling—Potential wastes or their components can be reused within existing operations.
- Novel cost-effective separation methods that result in highly effective separation of useful material from other components in a process stream.
- Development of new bulk materials and coatings with long life that have reduced environmental impact in manufacture or use.
- Improved sensor and multivariate control of manufacturing equipment and systems to reduce waste or emissions. Advancements in intelligent controls.
- Development of new alternative, cost-competitive, low-temperature sterilization processes to replace the use of ethylene oxide (EO) that are effective in treating complex medical device assemblies and machines, as well as their packaging, and that are suitable for use in a health-care setting (for background information, see: <http://h2e-online.org/about.asp> and <http://www.aha.org/ar/comment/ethylene.asp>).
- Development of cost-effective means for machining metals without the use of cutting fluids, especially for use in relatively small shop sites.
- Changes in the composition of end products that would allow fundamental changes in the manufacturing process or in the use of raw materials, or that reduce the relative environmental impact resulting from the use and/or disposal of such end products. Of particular interest are cost-competitive, mercury-free products, such as switches or thermostats, as well as products for hospitals and medical applications, including leaning agents, fixatives, and hospital-specific products. (More information on hospital products is available at: <http://www.sustainablehospitals.org>).
- Alternative Synthetic Pathways—The use of: (1) catalysis/biocatalysts, (2) natural processes such as photochemistry and biomimetic synthesis, and (3) alternate feedstocks that are more innocuous and renewable (e.g., biomass, solar energy).

- Alternative Reaction Conditions—The use of solvents which have a reduced impact on human health and the environment. The use of solvents with increased selectivity that reduce waste and emissions are a priority.
- New, cost-competitive technologies that reclaim and reuse foundry sand.
- New and non-toxic anti-bacterial cleaning products that sanitize food processing equipment with minimal use of water.

Another part of this topic includes engineering proposals that focus on industry-specific process technology and production equipment, including modernization, modification, or better control of process equipment. Process inputs, including changes in raw materials, either to different materials (e.g., water instead of organic solvents) or materials with different specifications (e.g., lower contaminant levels) also are of special interest. Priority sectors include industries under EPA's Sector-Based, Environmental Action Plan (see the EPA Website: <http://www.epa.gov/sectors>) and the Design for the Environment/Small Business Partnership, including metal finishing, printing, electronics, garment and fabric care, adhesives manufacturing, and safer chemicals and processes for automotive repair facilities and automobile and appliance assembly plants. Examples of industry priorities include, but are not limited to:

- Metal Finishing—EPA is interested in cleaner technologies that result in closed loop or low/no emission techniques for hard chrome plating, use of trivalent chromium and other metallic and non-metallic coating techniques that can replace hard chrome plating, and simple, inexpensive detectors that can monitor the amount of chromium in the air—especially in the presence of other pollutants (e.g., other heavy metals and fine particulate matter). Technologies that reduce the use of cadmium, lead, and other heavy metals that have low or no economic recycling value are of interest. New low/no emission chlorinated solvent vapor degreasing systems and technologies that eliminate the need for cyanide are of particular interest.
- Printing—EPA's Design for the Environment Program (DfE) has partnered with four sectors of the printing industry: screen printing reclamation products, lithography press cleaning solvents (blanket washes), flexography ink, and gravure technologies. Additional cleaner technologies are needed for these industry sectors so that printers

have a cleaner, safer, and more efficient way of doing business.

- **Electronics and Printed Wiring Boards**—The DfE Printed Wiring Board (PWB) Project is evaluating lead-free alternatives to the standard hot air solder leveling surface finishing process. Additional cleaner technologies are needed to reduce the number and amount of toxic chemicals used and the amount of hazardous waste generated, and to reduce water and energy use.
- **Garment and Fabric Care**—Dry cleaners are small businesses that are dependent on solvent technologies, including chlorinated and aliphatic hydrocarbon solvents. Emerging and innovative technologies include liquid carbon dioxide and commercial wet cleaning. More innovation in this small business sector is needed. A related area of interest is commercial laundries. Partnerships in commercial laundries are looking for alternatives to toxic and persistent surfactants, chlorine bleaches, and ecological undesirable builders.
- **Adhesives**—Development of low VOC adhesives, caulks, and sealers for automotive body assembly operations and/or for the building construction industry are needed.

B. CONTROL AND MONITORING OF MOBILE SOURCE EMISSIONS

This topic includes (1) new, innovative, and cost-effective technologies that prevent and control air pollution from mobile sources; and (2) new measurement and monitoring technologies applicable to vehicles and other mobile sources. Prevention and control of air pollution from stationary sources is Topic C and monitoring of air pollution (except air pollution from mobile sources) is part of Topic H.

Technology needs for controlling mobile source emissions include fuel modifications that reduce emissions and technologies for particulates, hydrocarbons, carbon monoxide, oxides of nitrogen, and toxic air pollutants (TAP). Areas of interest include, but are not limited to:

- Technologies for improved evaporative emission control systems in the areas of low leak/no leak fittings and connectors and lines and hoses with reduced or eliminated fuel seepage and permeation.

- Innovative and cost-effective techniques for the control of particulate emissions from diesel engines including on-road engines used in passenger vehicles and trucks, and non-road engines used in farm, construction, industrial, lawn care, and other non-road applications.
- New control technologies for controlling NO_x emissions from both diesel-fueled and gasoline-fueled engines of all types.
- Innovative technologies to control a method of combustion in engines known as Homogeneous Charge Compression Ignition (HCCI). The HCCI combustion method can result in low NO_x emissions and low particulate emissions at the same time, and this combustion method has been demonstrated with a variety of fuels. The Agency is interested in innovative ways to control this combustion type in a practical and cost-effective manner. It is expected that actual engine testing will be needed to demonstrate the effectiveness of any control approach.
- High pressure fuel pumps for direct injection (DI) engines. Many clean fuels that could be used in direct injection (DI) engines (e.g., dimethyl ether, methanol, and ethanol) present serious challenges for the design and operation of high pressure fuel pumps due to the low lubricity and corrosive nature of alternate fuels. New pumps should be able to demonstrate durable performance with low lubricity fuels and be of a practical manufacturable nature for potential cost-effective implementation.
- Innovative and cost-effective technologies to control directly emitted submicron size particles, secondary particles, and organic compounds from internal combustion and diesel engines. Innovative NO_x controls for mobile sources and systems for reducing or eliminating mobile source cold start emissions.
- Novel, cost-effective ways to remove benzene, 1,3-butadiene, and other toxics from gasoline and diesel fuel. Reducing or eliminating these fuel elements would reduce the exposure to people during the distribution and refueling process.
- Real-time particle sizer—As the interest grows in understanding the size distribution of particulate emissions below 2.5 microns, analytical instruments have become available that can measure the size distribution of particulates emitted from mobile

sources. What is needed is a particle sizer that could operate in real time to measure particle size distributions during actual engine and vehicle use.

This topic also includes monitoring of mobile source emissions. New approaches are needed to solve environmental monitoring and measurement problems associated with mobile sources. EPA is interested in the adaptation or extension of existing technology from other, non-environmental fields that can provide significant improvements in current environmental measurements. Specific areas of interest include, but are not limited to:

- Nitrous oxide instruments—In addition to carbon dioxide (CO₂) and methane (CH₄), nitrous oxide (N₂O) is a greenhouse gas which is emitted from mobile sources and which may be a concern. The Agency already has analytical capability to measure CO₂ and CH₄ using acceptable laboratory methods. What is needed is an instrument that can measure N₂O that would be more cost effective than the current FTIR method.
- Innovative and cost-effective measurement technologies to characterize activity patterns and ways in which mobile sources are used, such as specialized urban operations such as truck terminals, delivery truck terminal patterns, and weekend traffic patterns for all road vehicle types by time of day. For trucks, coupling the above data with roadway grade and truck loaded vehicle weight also are of interest. For non-road mobile sources such as those used in construction, industrial, and lawn care applications, technologies are needed for measuring activity patterns with high geographical resolution.
- Cost-effective, rapid, broadly inclusive measurement techniques for emissions from in-use vehicles and engines—In order to assess the effectiveness of the controls used on mobile sources, measurement technologies are needed that can measure emissions from engines and vehicles in use. Measurement approaches fall into two broad classes: 1) for the measurement of emissions that would permit recall or other enforcement actions, and 2) for the measurement of emissions that would allow gross emitters to be identified for necessary corrective action. Instrumentation that could be temporarily attached to a vehicle and instrumentation that can be operated remotely from the vehicle are both of interest. Instrumentation is needed that will measure hydrocarbons, CO, NO_x, particulates, and smoke for both gasoline-fueled

and diesel-fueled vehicles and engines, including those engines and vehicles used for over-the-road cars and trucks and those used for construction equipment, lawn and garden equipment, and other small engines.

- Source apportionment for particulates—When samples are taken of the particulate material in the atmosphere, it is of great interest to the Agency to know which sources contributed to the overall particulate material measurements. To the extent that the Agency's ability to apportion the overall result to the sources that caused it improves, then control strategies can be refined to be more cost effective. What is needed is a source apportionment methodology (including instrumentation) that is rapid, cost effective, and unambiguous. It would be desirable to be able to determine what percent of the ambient particulate came from mobile sources and of that, how much came from diesel-fueled vehicles and how much came from gasoline-fueled vehicles. Further apportionment within the mobile source fraction also would be desirable. To the extent that the methodology and instrumentation also can be applied to source apportionment for stationary sources of emissions, the Agency's interest would, of course, increase.
- Development of a small, portable analytical instrument that can be transferred between mobile emissions sources, such as construction equipment or lawn and garden equipment engines, during their actual use to measure CO, CO₂, NO, and hydrocarbons.
- Development of a small, portable analytical instrument and procedures for measuring fine particulate matter less than or equal to 2.5 microns aerodynamic diameter from mobile emission sources.

C. PREVENTION AND CONTROL OF AIR POLLUTION

This topic includes prevention and control of air pollution (1) from stationary sources, (2) indoor air pollution sources, (3) ozone depleting compounds, and (4) greenhouse gas emissions. Control of mobile source emissions is covered in Topic C and monitoring of air pollution is part of Topic H (except Topic B mobile sources monitoring). Research is needed on new, innovative, and cost-effective approaches that prevent or control emissions of

nitrogen oxides (NO_x), fine particles, volatile organic compounds (VOC), or toxic air pollutants (TAP) from stationary sources. Systems that can be used to control combinations of these pollutants are of particular interest. Areas of interest include, but are not limited to:

- Innovative and cost-effective techniques to control directly emitted submicron size particles, secondary particles, and organic compounds from stationary sources. Sources of particular interest include boilers, smelters, and animal waste operations.
- Innovative NO_x controls for stationary sources and cost-effective techniques to control emission streams with low concentrations of TAPs. VOC and TAP emission controls and prevention technologies for area sources, such as gasoline marketing operations, surface coating operations, and solvent usage related to consumer and commercial products.
- New, cost-effective sulfur oxides control techniques for the large number of smaller SO₂ emitters targeted for regulation by states as impacting short-term air quality standards from their relatively high concentration of SO₂ in stack gases.
- Advanced systems to capture gaseous contaminants such as acid gases, dioxins, and volatile metals simultaneously with SO₂. Techniques that control multiple pollutants, such as SO₂ and NO_x, or SO₂ and toxic metals, with one process step are of special interest.
- Cost-effective techniques to control and/or remove toxic air emissions, such as heavy metals, nitroaromatics, and extraordinarily active mutagens in vent and flue gases from combustion and/or industrial sources. Mercury from coal-fired combustors is of special interest. Also included are isocyanates from auto refinish spray painting and brominated flame retardant dust from plastics manufacturing operations.
- Innovative clay-based or other inexpensive sorbents for selective removal of toxic and other air pollutants from coal-fired power plant emissions. Control of mercury is of special interest.
- Technologies that allow leaking valves to be safely repaired online.

This topic also includes indoor environmental quality engineering research directed at: (1) determining the

nature of indoor air emissions and surfaces and how they contribute to human exposure, and (2) developing cost-effective tools, techniques, and technologies necessary to prevent or reduce individual exposure to indoor environmental pollutants. Areas of interest include, but are not limited to, development of:

- Methods to prevent biocontaminant growth in the indoor environment.
- Techniques to prevent/avoid dermal and/or ingestive exposure to hazardous chemicals on surfaces found in the indoor environment. Avoiding exposure by children and infants is of special interest.
- Air cleaners with improved ability to remove volatile organic compounds and small particulates from indoor air.
- Improved particulate air filters for residential and commercial heating, ventilating, and air-conditioning (HVAC) systems.
- Innovative, cost-effective techniques for conditioning outdoor ventilation air.
- New consumer/commercial products, building materials, or equipment that reduce the availability of harmful contaminants within the indoor environment. This could include reformulation or redesign of products, materials, or equipment, or substitution with lower-emitting raw materials. For example, a consumer interior paint or household cleaning product might be reformulated with lower-emitting raw materials so that it emits less into the indoor environment.

EPA also is interested in new technologies and alternatives for ozone depleting compounds. EPA is interested in replacing substances that harm the stratospheric ozone layer (such as chlorofluorocarbons (CFCs) and halon fire suppressants) with safer alternatives and technologies. Research is needed to continue the process of finding non-ozone depleting substances to replace CFCs and other ozone depleting substances (ODS). Many commercial sectors are affected by the phaseout of ODS, including the refrigeration, air conditioning, and fire extinguishing systems and foams industries. Examples of areas where research is needed include, but are not limited to:

- Development of systems to reduce the amount of hydrogen fluoride generated during the use of hydrofluorocarbon (HFC) fire suppressants.

- Development of better and more efficient fire suppressants and systems, including compounds that meet weight restrictions, use available substitutes in a more efficient manner, technologies more efficient for putting out fires, delivery enhancement, and optimizing the amount of agent delivered.
- Development of cheaper, more reliable fire detection methods and systems.
- Development of low-ozone depleting substances in coatings and inking applications.
- Alternatives to methyl bromide, particularly non-chemical alternatives such as steam sterilization and solarization for soil fumigation or irradiation and CO₂/heat treatment.
- Development of very-low-temperature (e.g., -50° C) refrigerants or alternative technologies.
- Development of manufacturing techniques and/or processes to increase the insulation value and improve the dimensional stability of foam manufactured with non-ozone depleting substances.
- Development of air-conditioning and refrigerant technologies that reduce system leaks, (e.g., using hermetic systems instead of open systems for end uses where leaks are significant, or by incorporating self-sealing additives into air-conditioning components which would minimize leaks).
- Development of systems that would enable use of smaller refrigerant charge or appropriate use of flammable refrigerants, (e.g., the use of hydrocarbons or ammonia with secondary loops).

Another priority for EPA is reducing Greenhouse Gas (GHG) emissions. Gases of concern are methane, carbon dioxide, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. EPA is interested in prevention and control technologies for GHGs where there are multiple pollution reduction benefits for GHGs and other pollutants such as toxic metals, mercury, and hazardous air pollutants. Technologies that only involve energy efficiency, where the pollution reduction benefit is indirect reduction of power plant emission, are addressed by other agencies and are technically unacceptable. Of high interest are areas for which little success has been achieved, for which little is being done, or where a significant improvement can be made over an existing or devel-

oping way to reduce GHG and other pollutant emissions. Some of these areas include, but are not limited to:

- New, environmentally safe chemicals (e.g., blends of chemicals to reduce flammability of potential refrigerants) and intelligent controls (e.g., fuzzy logic and neural networks) to reduce GHG emissions.
- Ways to reduce, detect, collect, and utilize waste methane from various sources including animal husbandry and landfill.
- Improved processes or process modules for utilizing biomass or other renewable energy sources (e.g., better conversion efficiency of biomass to liquid fuels for transportation to provide co-control of environmental burdens).
- New ways to improve control of aluminum production to reduce perfluorocarbon emissions.
- New insulation materials or processes to replace uses of sulfur hexafluoride.

D. TREATMENT AND MONITORING OF DRINKING WATER

The topic includes technologies for treating and monitoring drinking water. Technologies for municipal and industrial wastewater treatment, stormwater management, and rehabilitation of urban infrastructure systems are part of Topic E.

The Safe Drinking Water Act requires that public water supplies be disinfected and that EPA set standards and establish processes for treatment and distribution of disinfected water to ensure that no significant risks to human health occur. The EPA Science Advisory Board has ranked pollutants in drinking water as one of the highest health risks meriting EPA's attention due to the exposure of large populations to contaminants such as arsenic, lead, methyl tertiary butyl ether (MTBE), disinfection by-products (DBPs), and disease-causing organisms. Disinfectants are used by virtually all surface water systems in the United States and many systems that rely on groundwater. Chlorine has been the most widely used and most cost effective disinfectant. However, disinfection treatments can produce a wide variety of by-products, many of which have been shown to cause cancer and other toxic effects. There also is concern that water quality can deteriorate dramatically during distribution unless systems are properly designed

and operated. Innovation is needed to upgrade existing techniques as well as to develop new approaches to address these problems. Areas of interest include, but are not limited to:

- New, innovative treatment methods or techniques that improve performance of existing drinking water treatment plants for removal of MTBE and other oxygenates and by-products associated with petroleum product releases.
- Alternatives to chlorine disinfection for removing pathogenic microorganisms, including innovative applications of ultraviolet radiation and processes that improve overall effectiveness while using reduced amounts of disinfectant.
- Development of innovative unit processes, particularly for small systems, for removal of organic, inorganic and radionuclide contaminants (such as perchlorate, aluminum, pesticides, arsenic, nitrate, radium, etc.), particulates, and pathogens (e.g., cyst-like organisms [Cryptosporidium] and emerging pathogens like caliciviruses, microsporidia, echoviruses, coxsackieviruses, adenoviruses, and others on the Drinking Water Contaminant Candidate List). More information is available from the following Website:

(<http://www.epa.gov/safewater/ccl/cclfs.html>).

- Development of efficient, cost-effective treatment processes for removing disinfection by-product precursors and innovative methods that minimize their formation.
- Controls for drinking water contamination between the treatment plant and the user. EPA is concerned about potential chemical leaching (copper and lead) from distribution system materials and surfaces and biological regrowth in the distribution system.
- Implementation of centrally-managed Point-of-Use drinking water control methods, especially for control of arsenic.
- New methods to manage residuals from drinking water treatment, including coagulant recovery and beneficial reuses. Membrane brines and treatment of backwash are a concern. Reuse of regenerant brines and their ultimate disposal also is a concern.

- Small, effective, inexpensive water purification devices are needed for home use. Recent research indicates that most groundwater and surface water in the United States contains one or more pesticide related compounds. Current water treatment technology may not remove these compounds. In addition, a large percentage of the U.S. population receives its drinking water from small sources or private wells that are not regulated under the Safe Drinking Water Act. Home water purification capable of removing polar and nonpolar pesticides are needed to ensure that safe drinking water is available.

New approaches are needed to solve drinking water monitoring and measurement problems. EPA is interested in the adaptation or extension of existing techniques from other, non-environmental fields that can provide significant improvements in current environmental measurements. Specific areas of interest include, but are not limited to:

- Portable measurement technologies that can be used in the field to eliminate packaging and shipping samples to distant laboratories, and yield real time information at a lower cost. Such technologies need to be rugged, sensitive, and suitable for the wide variety of drinking water samples that are commonly analyzed (source water assessment and for use in the distribution system). Ability to measure multiple pollutants simultaneously would be a plus factor. Rapid field tests also are needed by personnel responding to crisis situations such as spills and accidents.
- Improved measurement of microbial pathogens in drinking water systems is of special interest. Improved methods for Cryptosporidium are a priority. Better methods also are needed for measuring other cyst-like organisms and emerging pathogens like caliciviruses, microsporidia, echoviruses, coxsackieviruses, adenoviruses, and others on the Drinking Water Contaminant Candidate List. Inaccurate and highly variable methods contribute to uncertainty of the extent of health risks from exposure to drinking water containing these pathogens including the viability of cysts, oocysts, and viruses found in drinking water systems. Research is needed to develop practical, low cost, accurate, and specific methods to identify and quantify viable pathogens in raw and finished drinking water systems.

- Research is needed to develop sensitive, accurate, and specific rapid screening technologies and methods to detect algal neurotoxins and cytotoxins in source water and drinking water. The analytical techniques should be appropriate for use in measuring algal toxin occurrence at or shortly after the time of sample collection.
- Online, *in situ* monitors for drinking water, including source water monitoring and protection, treatment, and distribution system monitoring.
- Improved measurement of disinfection by-products (e.g., for ozonation: bromate, aldehydes; for chlorination: chloropicrin, haloacetonitriles; for chloramination: organic chloramines, cyanogen chloride). Innovative approaches for disinfectants (in particular ozone) and precursors are needed, as well as portable measurement technologies and rapid field test kits.

E. WASTEWATER TREATMENT AND STORMWATER MANAGEMENT

The topic includes municipal and industrial wastewater treatment, stormwater management and rehabilitation of urban environmental infrastructure. Technologies for treating and monitoring drinking water are included in Topic D and wastewater and stormwater monitoring and measurement technologies are part of Topic H.

Research is needed to improve existing municipal wastewater treatment processes and treatment and management of septage and sewage sludge (biosolids). Existing treatment and management systems often fail to perform as intended due to unforeseen factors not considered in the plant design, usually related to upsets in the process itself or inefficiencies in ancillary treatment and control processes. Specific areas of interest include, but are not limited to:

- Process technologies and cost-effective modifications to enhance reliability of achieving secondary and reuse quality effluent from municipal treatment facilities with design flows less than 5 million gallons per day.
- New, cost-effective technologies that improve treatment efficiency at municipal wastewater

treatment facilities with design flows less than 50,000 gallons per day.

- Cost-effective alternatives to the chlorination of outfalls from municipal wastewater treatment plants, emphasizing the identity and characteristics of by-products associated with the alternative treatments.
- Innovative, cost-effective techniques for removing phosphorus and nitrogen nutrients from municipal wastewater, particularly in small (<10,000 population) or decentralized systems.
- Nontoxic anti-biofoulers are needed for exotic biological species such as the zebra mussel. Development of nontoxic methods to control such species would be a major contributor to the protection of the Great Lakes and many inland waterways.
- Innovative methods to manage and treat septage.
- New treatment techniques for unsewered residential and commercial wastewaters to permit onsite reuse, thus reducing the demand for larger centralized sewage systems.
- Process concepts and modifications to enhance reliability of achieving Class A biosolids quality and biosolids vector attraction requirements of 40 CFR Part 503. Methods to control pathogenic bacteria, enteric viruses, and viable helminth ova to below analytical detection levels.
- Process concepts and modifications to create or enhance the use of natural systems (e.g., constructed wetlands, land treatment), especially for use with small flows.
- Cost-effective treatment technologies for removal of pesticides from discharges to surface waters.

Research is needed to address environmental and public health problems associated with industrial sources including mining and animal feeding operations. Innovative methods are needed to improve existing industrial wastewater treatment processes which often fail to perform as intended due to unforeseen factors not considered in the plant design, usually related to upsets or inefficiencies in the treatment processes. Mercury contaminated surface waters and groundwaters and technologies that remove oil and other contaminants from surface waters are of special interest. Areas of interest include, but are not limited to:

- Technologies to contain and treat uncontrolled air and unsewered wastewater from animal waste from large animal husbandry operations including pig, chicken, and turkey farms. Development of methods that complement or replace existing lagoon and field spraying operations that release ammonia to the atmosphere, saturate and contaminate groundwater, and overflow into waterways during periods of heavy rainfall.
- Technologies that minimize adverse environmental impacts associated with cooling water intake structures that direct water into a facility to the first intake pump(s). The primary concern is the impingement and entrainment of fish and other aquatic organisms in the facility's intake structure. Impingement refers to the trapping of fish and other aquatic life against cooling water intake screens. Entrainment occurs when aquatic organisms, eggs, and larvae are sucked into the cooling system through the heat exchanger and then are pumped back out. New and cost-effective technologies should focus on the location, design, construction, and capacity of the cooling water intake structure to minimize adverse environmental impacts.
- Process concepts and modifications to enhance reliability of achieving high efficiencies for industrial wastewater treatment systems from facilities with design flows less than 50,000 gallons per day.
- Economical processes for treating drainage from abandoned factories, coal mines, etc., including low-cost treatment of drainage and coal mine spoils.
- Innovative techniques and technologies for management of runoff from mine wastes (i.e., overburden, leachate, and solids from tailings).
- Low-cost processes for controlling wastewater discharges containing volatile or toxic organic pollutants or pesticides.
- Innovative technologies are needed for treatment and control of bilge/ballast water within vessels, especially important for residual chemicals and oily wastes entering the Great Lakes, Houston Ship Channel, Baltimore Harbor, etc.
- Cost-effective alternatives for treating and recycling animal manure, including use of these organic residues as a source for methane-rich fuel gas for combustion and/or protein or fiber as

feedstocks for construction materials and other specialized products.

- Mercury contaminated surface water and groundwater is of special interest. Technologies are needed to remove mercury in its various forms including methylmercury. Also needed are innovative technologies and robust extractants (i.e., cross-linked polystyrene polymers, selective ion-exchange resins, special membranes) that selectively remove mercury even in the presence of competing metal ions (e.g., Hg(II), Cd).
- Technologies are needed to remove oil, fuels, and other contaminants from surface waters. Special attention is needed to remove dilute wastes, especially in remote areas.

Research also is needed to improve the treatment and control of urban stormwater runoff from transportation corridors carrying trash, sediment, oil and grease, nutrients, metals, and petroleum hydrocarbons. Many densely urbanized areas are not suitable for the application of land-intensive stormwater control measures such as wet ponds, vegetated swales, and infiltration trenches. Alternative technologies fall into a number of categories, including catchment inlet traps or inserts, oil/grease and debris separators, sedimentation chambers, filtration chambers, and detention/exfiltration systems. The development of innovative technologies to treat urban runoff from roads, bridges, and other impervious surfaces will improve the quality of stormwater discharges. Areas of needed research and interest include, but are not limited to:

- Development of cost-effective technologies for preventing toxic substances and pollutants from entering storm or combined sewer/drainage systems.
- Development of monitoring technologies and equipment to measure the characteristics and impacts of wet weather flows (WWF), including pathogenicity.
- Development of high-rate and high-efficiency WWF treatment technologies suitable for retrofitting existing wastewater treatment plants as well as for new installations.

Rehabilitation of urban infrastructure systems is also a priority. The aging condition of our cities and deterioration of infrastructure includes water distribution and sewerage systems. This provides an important research area addressing how to repair and maintain this infrastructure. The costs are staggering; the national investment in sewers

alone approaches \$1.8 trillion. Excessive flow to the sewer system from infiltration and inflow (I/I) robs the capacity of the sewer system and negatively affects proper operation of the entire sewerage system. I/I has caused surcharging of sewers, wastewater treatment plants, and pumping stations. Building connections to the street sewers or laterals can contribute as much as 70 - 80% of the infiltration load. With current technology, building connection rehabilitation may not be economically feasible because of the sheer number of connections. Less expensive technologies other than acoustic approaches are needed to detect leaks, forecast structural failures, and repair/rehabilitate sewers and other utility pipelines such as municipal pressurized water distribution and possibly heat distribution systems. Areas of needed research and interest include, but are not limited to:

- New sewer materials and construction/maintenance techniques and new technologies to repair existing sewer infrastructure at an acceptable cost.
- New technologies to construct, maintain, and repair new and existing urban utility/steam and water distribution systems infrastructure at an acceptable cost.
- New pipe materials, relining techniques and innovative materials for water distribution systems.

F. HAZARDOUS WASTE MANAGEMENT AND SITE REMEDIATION

This topic includes management of hazardous solid waste and sediments, and remediation of contaminated sites, soils, sediments, and groundwater. Management, treatment, and recycling of municipal and industrial solid waste is included in Topic G.

Innovative approaches are needed for hazardous wastes, including incineration and other treatment, and disposal in conventional or special landfills. Contaminated sediments now appear to be the main source of toxic contaminants in many bays, lakes, and rivers. Areas of interest include, but are not limited to:

- Innovative methods for the operation and control of high-temperature waste combustion incinerators that lead to reduced contaminant release through air, water, or residual ash streams. Of special interest is mercury, one of the worst emission problems for waste incinerators. The current technology for capturing mercury is injection of sorbents/reactants

into the flue which results in the capture of mercury along with fly ash in electrostatic precipitators or baghouses. This creates a problem with disposal of the mercury-contaminated fly ash or scrubber solution. Improved technologies are needed to retrofit incinerators for optimum capture of the mercury and minimization of mercury-contaminated waste by-products.

- Advanced hazardous constituent destruction technologies using cost-effective thermal, chemical, and biological detoxification methods.
- Innovative ways of preventing or treating/detoxifying wastes prior to land disposal, particularly those containing highly *persistent, bioaccumulative and toxic* constituents (e.g., improved means of leaching toxic constituents from wastes in a landfill environment to render the wastes innocuous within the period of operation and post-closure care). Of particular interest are immobilization technologies suitable for mercury-bearing wastes. More information on the Agency's strategy for "PBT Chemicals" is available at the following Website: <http://www.epa.gov/pbt>.

This topic also includes remediation of organically contaminated soil, sediments, and groundwater and treatment or removal of heavy metals at contaminated sites. Certain locations within the United States have become contaminated with heavy metals and hazardous and toxic organic substances. Contaminants have permeated and adsorbed onto soils, diffused to interstitial saturated zones, dissolved into groundwaters and migrated to subsurface aquifers. In many instances, contaminants have exhibited physical and chemical properties that make them difficult to remove from the environment. Contaminants may exist in subsurface deposits as immobile gums or sludges difficult to access. They may be resistant to normal subsurface chemical and biological degradation processes. They may strongly adsorb on soil structures and be only slightly soluble in aqueous concentrations.

Proposals are solicited that will result in the development of innovative, cost-effective methods for the *in situ* or *ex situ* treatment or control of heavy metals and hazardous organic wastes. Also needed are *in situ* technologies that mobilize contaminants to make them more amenable to subsequent *ex situ* or *in situ* treatment or extraction. Biological techniques that utilize genetically engineered microorganisms can be included, but will require the proposer to provide any special clearances needed for such projects. Clearance information on genetically engineered bioremediation microorganism use can be obtained from

EPA's Office of Pollution Prevention and Toxics (contact Jim Alwood at 202-260-1857). Information on the EPA biotechnology program is available at the following Website: <http://www.epa.gov/opptintr/biotech/>.

Innovative and cost-effective technologies are needed in areas including, but not limited to:

- Innovative *ex situ* and *in situ* treatment technologies for mercury-contaminated soil, sediments, and groundwater are of special interest. Mercury exists as organo-mercury complexes, phenyl mercury, methyl mercury, and mixed mercury wastes. Cost-effective, innovative technologies are needed to treat, remove, or immobilize these forms of mercury.
- Improved treatment and disposal of solid and/or liquid wastes or sediments, including detoxification, solidification, chemical treatment, neutralization, or otherwise fixing organic waste prior to disposal in landfills.
- Cost-effective techniques and technologies are needed to clean up groundwater and sites contaminated by oxygenates that currently are used or are likely to be used in reformulated gasoline and oxygenated winter fuels. Improved leak detection methods and better site characterization tools also are needed. These substances include MTBE and other fuel oxygenates (e.g., ethers, alcohols, and alkylates). Fuel oxygenates are used in gasoline in numerous states for CO and ozone precursor reduction and may enter the environment through leaking fuel storage tanks, spillage, and emissions from passenger vehicles and watercraft. Detection and characterization proposals should consider the problem that oxygenates like MTBE do not have the same plume profile as monoaromatic hydrocarbons (benzene, toluene, ethylbenzene, and the three isomers of xylene [BTEX]). Treatment technology proposals should consider cost effectiveness and recognize that leaks often occur in densely urban areas.
- Chemical detoxification, such as neutralization and dehalogenation or electrochemical decomposition.
- Physical methods for subsurface mixing to enhance mobilization and mass transfer.
- Biotreatment methods in the saturated and unsaturated zone.

- Approaches for detecting, degrading, and removing dense non-aqueous phase liquids (DNAPL) from groundwater. DNAPLs are usually highly concentrated, small pockets or strands of semi-pure VOCs. Special needs include better methods for locating DNAPL pockets and cost-effective *in situ* destruction technologies.
- Improvement in nutrient and chemical reagent delivery systems for biological or chemical methods.
- Innovative physical separation, thermal processing (i.e., *in situ* or high vacuum thermal desorption), electrokinetics, and hydrometallurgical processing technologies are needed to separate and recover mercury. *Ex situ/in situ* remediation of mercury in groundwater or surface water including low-cost ion exchange resins, polymers, ligands, or ceramic media are of interest to EPA.
- Physical methods for subsurface mixing to enhance mobilization and mass transfer of heavy metals.
- Improved methods for treatment of heavy metals by reduction of their bioavailability in soils.
- Improvement in nutrient and chemical reagent delivery systems for biological or chemical methods for heavy metals removal.
- Improvement in heavy metal reaction product recovery and separation systems that enhance the commercial value of these products.

G. RECYCLING OF MUNICIPAL AND INDUSTRIAL SOLID WASTE

This topic includes management, treatment, and recycling of municipal and industrial solid waste. Management of hazardous solid waste and sediments, and remediation of contaminated sites, soils, sediments, and groundwater are included in Topic F.

The nation's municipal solid waste (MSW) recycling infrastructure includes more than 12,000 drop-off sites and some 9,000 curbside programs that collect recyclable materials. Over 27% of MSW was recycled in 1996 and more than 57 million tons of recyclable materials re-entered manufacturing processes to make new products and packaging. MSW recycling is a complex and growing industry ripe for innovation both in the collection of recyclable materials and in the processing of those materials into us-

able goods. Areas of interest for innovation include, but are not limited to:

- Storage, collection, and transport of recyclables from multi-family and single family residences, including high-rises, and from commercial establishments such as stores, restaurants, construction sites, etc.
- Processes to separate recyclables (e.g., various plastic resins) and to remove contaminants (e.g., adhesives not soluble in water) from recyclable materials.
- On-site or en route processing of recyclables (e.g., bottle crushing at bars or restaurants, paper processing at offices or print shops, plastics shredding on collection trucks).
- Technologies for improving quality control for recyclable materials or to identify the extent to which contaminants are present.
- Alternative or new uses and products for recyclable materials (e.g., using recycled glass bottles to produce something other than glass bottles, using recycled newspaper to produce something other than newsprint, using plastic bottles to produce something other than bottles).
- Innovative recycling of organics (e.g., using the compost process to treat manures, composting of restaurant wastes, using compost for bioremediation).
- Re-designing products to enhance their recyclability (e.g., recycling-friendly adhesives, bottle coatings to substitute for colored glass).

Innovative approaches are needed for nonhazardous municipal and industrial solid wastes. Areas of interest include, but are not limited to:

- Innovative methods and technologies for the operation and control of high-temperature waste combustion incinerators that lead to reduced contaminant release through air, water, or residual ash streams.
- Multiple recovery and recycling of different plastic materials in automobile salvage operations.
- Improved methods that control odor and air emissions from municipal landfills.

- Advanced physical separation techniques that make wastes easier to treat or destroy by moving the metal/organic constituents from one medium to another.
- Recovery processes that may enable the economic recovery of valuable components from solid waste that may then be sold and/or recycled off site.
- Innovative new uses for waste materials from industrial sources, particularly for materials of which large amounts are not being recycled presently, to reduce landfill and disposal costs.
- An improved technique for the rapid removal of the paint from a variety of architectural surfaces. The system should soften and/or loosen the paint film and physically strip it from the surface to comply with the Housing and Urban Development (HUD) cleanliness standards. The method should minimize the generation of small dust or fume particles while capturing the paint film as it is removed. It should be four or five times faster than existing techniques and avoid the use of toxic and/or hazardous chemicals, especially volatile organic compounds. The system must produce a surface that can be repainted or include an inexpensive refinishing step to permit refinishing.

H. MONITORING AND MEASUREMENT TECHNOLOGIES

New approaches are needed to solve environmental monitoring and measurement problems. EPA is interested in both remote and *in situ* monitoring and measurement approaches. EPA also is interested in the adaptation or extension of existing techniques from other, non-environmental fields that can provide significant improvements in current environmental measurements. Specific areas of interest include, but are not limited to:

- Measurement of physical, chemical, and biological water quality parameters. Instream water monitoring devices that economically record physical parameters and specific chemicals *in situ* and send information in real time to receiving stations.
- Continuous monitors of organic and inorganic toxicants in municipal and industrial wastewater and their toxic effects on receiving waters.

Major improvements in process control, compliance monitoring, and environmental decision making could be made if more accurate, less costly, more rugged techniques were available, including remote sensing devices, that would yield continuous data on pollutant concentrations in environmental media. Examples of situations where advances are needed include, but are not limited to:

- Continuous monitors of toxic metals (particularly mercury) and/or organic compound emissions from high temperature, complex matrix sources such as incinerators, fossil fuel based power plants, cement kilns, and smelters.
- Continuous monitors of release of volatile compounds from complex point sources or area sources such as tanks, pipes, valves, landfills, and contaminated soils under ambient conditions.
- New online measurement techniques for continuous monitoring and process control of metal or trace organic air pollution emissions. Instruments to measure air quality from nonpoint sources such as pesticide drift and construction-related dust.
- Alternative monitors that provide similar data to expensive monitoring wells of groundwater resources, including refinements of CPT/hydropunch techniques.
- Development of a portable, integrated system that can capture and measure in real time large leaks from refineries and other oil and gas or chemical process equipment flanges, valves, and pump seals.
- Technologies that detect leaks of organic and inorganic chemicals from the perimeter of the process unit. Technologies with the ability to detect leaks of a variety of chemicals, at least as sensitive as the current Method 21, the ability to operate from the perimeter of a chemical process unit, and technologies with a sufficient resolution to identify the specific component that is leaking.
- Cost-effective monitoring technologies that are capable of monitoring multiple toxic air pollutants (TAP), ambient monitoring techniques for TAP, and technologies that can be used for compliance monitoring purposes.
- Measurement of the size distribution and dry mass of inhalable particulate matter ($PM_{2.5}$ and PM_{10}), including semi-volatile organic toxicants and ammonium nitrate in air.

- Mass measurements of particle-bound water in airborne inhalable particulate matter ($PM_{2.5}$ and PM_{10}).
- Analytical monitors for hazardous air pollutant emissions from curing coatings based on the resin and hardener chemical properties, including the analytical procedures for their measurement.
- Cost-effective continuous emission monitoring system that can be installed on industrial process emission vents and stacks to continuously measure concentrations of heavy metals (e.g., mercury) or organic hazardous air pollutant compounds. Devices must be rugged, sensitive, and yield real-time data for multiple or single pollutants.
- Cost-effective technology for the measurement of particulate emissions concentrations in industrial process and combustion stack or vent exhaust gases on a continuous basis.
- Technology for measuring opacity of emissions from combustion and other industrial processes at levels less than 10% opacity. Technology should include development of calibration standards and techniques for opacities down to 0% and data quality criteria suitable for operating continuous opacity monitoring systems.
- Technology for collecting and assuring representative sampling and loss minimization for particulate air toxics emissions from combustion and industrial process emissions stacks and vents.
- Technology for determining the species composition of particulate matter samples from combustion and industrial process emissions stacks or vents.
- Technology transfer from ambient monitoring to continuous monitoring of combustion or industrial process stack or vent emissions for criteria or hazardous air pollutants.

This topic also includes priority problems associated with developing new systems for monitoring hazardous waste sites, technologies and alternatives for ozone depleting compounds, prevention and control of greenhouse gas emissions and indoor air pollution, and reduction of environmental and human health risks from pesticide use.

EPA's Office of Solid Waste and Emergency Response (OSWER) is interested in technological advances in chemi-

cal constituent identification, quantification, and geo-physical analysis that will improve capabilities to characterize hazardous waste sites, monitor remedial activities, and provide long-term monitoring for closed sites.

OSWER's Monitoring and Measurement Technologies for the 21st Century or 21M2 initiative will identify and support promising measurement and monitoring technologies in response to waste management and site cleanup program needs. EPA has identified areas where significant technology needs or gaps exist and, thus, require research to help address these needs. EPA is seeking research proposals for *in situ* sensors for monitoring groundwater contamination and treatment system performance and technologies including, but not limited to:

- As more and more pump-and-treat (and other water treatment) systems enter the operations and monitoring phase of implementation, techniques which either effectively monitor the behavior of the contamination plume or the performance features of the system are essential. *In situ* sensor technologies or techniques are needed that either improve the capacity to monitor the presence and concentration of contaminants, particularly chlorinated solvents, in the saturated zone or significantly decrease the cost of existing techniques for monitoring these contaminants. Techniques that allow for remote operations through telemetry also are of interest as are techniques, which in conjunction with modeling processes, allow for optimization of monitoring and/or operating treatment systems.
- Federal and state underground storage tank (UST) cleanup programs need remote-telemetry compatible sensors that measure reductions in BTEX or MTBE levels in soil and groundwater at several hundred thousand ongoing and new UST cleanup sites. These sensors should produce either continuous or statistically-determined periodic signals indicating BTEX or MTBE levels or both. Each sensor should have a self-contained power source with a life of 3 to 5 years and be capable of interfacing with either remote-telemetry data-capture systems or hand-held data-capturing devices applied on-site.

EPA also has identified significant technology needs for research proposals for continuous emissions monitors for use with thermal hazardous waste treatment systems, remote sensing for fugitive emissions, new monitoring methods for cyanides and cyanide speciation, leak detection technologies for small landfills, monitoring for mining waste sites, technologies for locating and monitoring DNAPL contamination, UST internal inspection methods,

and noninvasive monitoring technologies for mercury and heavy metals in soil. Technologies are needed as follows:

- Compliance with air emission standards or limitations has traditionally been determined by initial and periodic "stack tests," and establishment of operating parameters with the goal of ensuring day-to-day compliance. This approach involves long-time intervals, uncertainties that day-to-day emissions are meeting acceptable limits, and questions about measuring all of the potential "products of incomplete combustion" (PICs). Technologies or techniques are needed that allow real-time/near real-time ability to measure stack emissions for toxic organic and heavy metal air emissions. The current standard for dioxins and furans is 30 ng TEQ/dscm. According to EPA's combustion strategy (November 1994), the proposed new performance standard for Municipal Waste Combustors is 0.2 ng TEQ/dscm. Technologies and techniques for dioxin and furan monitoring are needed that address the problem that these contaminants can occur in both gaseous form and attached to particulate matter.
- Remote optical sensing is needed for fence-line monitoring for fugitive emissions and enforcement activities. Emergency response/removal operations, compliance/enforcement functions, and operation of treatment technologies in both the Superfund and corrective action programs require systems that effectively monitor for fugitive emissions of hazardous air pollutants along the "fence-line" of a site. The effectiveness of a fence-line monitoring technique is a function of the length of the fence line, number of monitoring points, the receptors' locations, the source size and strength, and the compounds of concern. Real-time/near real-time monitoring of toxic organic pollutants is needed at all points downwind at the fence line of a facility using remote optical sensing technology.
- EPA needs more accurate, reliable, and enforceable technologies, techniques, and tests to monitor total cyanides and to speciate cyanides. The Agency is particularly interested in techniques based on alkaline digestion and ion chromatography.
- Cost-effective technologies are needed that allow for protective methods to verify the integrity of and/or detect leaks from municipal landfills, focusing on the special needs of smaller capacity facilities. Examples may include (but are not limited to) remote platforms that provide cost-

effective monitoring of the integrity of engineered covers. In addition, sensors are needed to monitor the integrity and effectiveness of slurry walls and liners. This need includes systems designed for containment purposes and systems designed for containment and passive treatment (e.g., permeable reactive barrier systems). Such platforms/sensors, with appropriate telemetry, should allow timely remedial action that minimizes the frequency and extent of contaminant releases from the containment system and reduces the potential for human and environmental exposure.

- Monitoring technologies are needed for mining waste sites. Superfund mining sites pose a unique and significant challenge because they often cover a large geographic area and include a very large volume of contaminated media resulting from mining operations (e.g., waste materials from mine excavation or mineral separation activities or contaminant releases from such activities). The Agency needs low-cost, low-maintenance monitors and advanced remote-sensing based tools (i.e., air and space-borne) for characterizing the extent of contamination at very large mining waste sites, monitoring releases, assessing risks, and planning and implementing remediation measures. These tools should provide information on the location and areal extent of mining activities and related waste piles; on the nature and extent of releases from active and inactive mines; and on contaminants, particularly metals, and their concentrations.
- Technologies are needed for locating and monitoring dense nonaqueous phase liquids (DNAPLs) contamination. Monitoring for the presence and persistence of nonaqueous phase liquids (NAPLs), particularly DNAPLs, presents a continuing challenge to the operation and effectiveness of remedial systems for treating contaminated groundwater. EPA needs noninvasive or minimally invasive technologies or techniques that can locate, identify, and characterize DNAPL contamination in the subsurface. Technologies should be capable of locating small volumes of DNAPL, assisting with the characterization of the contamination, assisting with the visualization of the DNAPL relative to the feature of the subsurface hydrogeology, and supporting the optimization of treatment systems.
- Internal inspection methods are needed for internally-lined underground storage tanks (USTs).

EPA estimates that 50,000 to 100,000 USTs are internally-lined and will need to be periodically inspected in order to continue to meet state and federal UST requirements. States have expressed a concern over how these inspections will be conducted as tank linings become 10 years old. Currently, EPA is aware of only one code of practice for conducting the internal inspection, National Leak Prevention Association (NLPA) Standard 631, Chapter B. NLPA 631 requires human entry into the UST to measure thickness, hardness, conduct a holiday (spark) test, and perform ultrasonic measurements on the steel tank shell. State inspectors and owners/operators of lined USTs would benefit from having multiple technologies available for internally inspecting internally-lined USTs. EPA is seeking technologies/methods for conducting the inspection that can meet the regulatory language at 40 CFR part 280.21, which requires the following be done (for petroleum and hazardous substance tanks) in accordance with a code of practice developed by a nationally recognized association or independent testing laboratory: Within 10 years of lining and every 5 years thereafter, the lined tank is internally inspected, the lined tank is found to be structurally sound, and 3/4 of the lining is still performing in accordance with original design specifications.

- New leak-detection technologies that are more sensitive, less prone to human error, and cost effective are needed for detecting releases from USTs and pipes. More than 800,000 UST systems must conduct leak detection. Although there are multiple leak detection technologies in use, most only detect a release once it exceeds a certain threshold (e.g., flow rate). In addition, the regulated community, which includes many small businesses and governments, is frequently stymied by the complexity of current technologies. The Agency is concerned that current technologies and thresholds may not be effective, given the prevalence of substances, such as MTBE, that are more mobile and persistent in the subsurface than BTEX.
- EPA needs field instrumentation to enhance characterization of soil at sites in the United States that have become contaminated with mercury and heavy metals. Of special interest are new, noninvasive technologies such as electromagnetic radiography that eliminate core sampling, save time, and reduce monitoring costs.

The last part of this topic involves pesticides. Under the authority of The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), The Federal Food, Drug, and Cosmetic Act (FFDCA), and The Food Quality Protection Act of 1996 (FQPA), the EPA Office of Pesticide Programs (OPP) is charged with protecting public health and the environment from risks posed by pesticides, and with promoting safer means of pest control. To carry out this mission, OPP must be able to measure the effects of pesticides and their degradation products. This topic relates to that mission by requesting research aimed at increasing OPP's ability to monitor occurrence and movement of pesticides and their degradation products in the environment. Examples of research needed include, but are not limited to:

- Equipment and methods are needed for *in situ* monitoring of nonpersistent pesticides and pesticide degradation products in soil, water, and air. Time delays for collecting and transporting samples to laboratories for analysis reduce our ability to track the occurrence and movement of pesticide compounds in the environment.
- Simple, accurate pesticide and pesticide degradation product detection methods are needed for individual homeowner use.
- Technologies and methods are needed for detecting pesticide residues on food and plant surfaces in the field.
- Technologies and methods are needed that allow consumers to check produce for the presence of pesticides and pesticide residues on fruit and vegetables at the point of purchase. This would allow consumers to make an informed decision before buying agricultural products that may contain pesticide chemicals.
- Technologies and methods are needed for evaluating the effects of chemical mixtures. For example, alachlor, atrazine, and aldicarb show little individual toxicity in concentrations currently observed in the environment. When multiple pesticides are present, the toxicity of the mixture may be significantly greater. Currently, regulatory decisions are made based on single compounds and additive or synergistic effects are not considered. New technologies and methods are needed for mixtures.
- New test systems are needed for evaluating hormonal disruption potential for new and existing pesticides and pesticide degradation products in

non-mammalian species. Under the FQPA, EPA is required to establish an endocrine disruption screening and testing program for pesticides. New technologies and better tests are needed for non-mammalian species (i.e., fish, amphibians, and reptiles).

- Technologies and *in situ* methods are needed for monitoring lethal and sub-lethal effects of pesticides and pesticide residues on birds, fish, and other organisms. For example, it is difficult to determine if a pesticide application has had an effect on local bird populations. A method for detecting bird kills would allow better evaluation of environmental risks of a pesticide.

X. SUBMISSION FORMS AND CERTIFICATIONS

The attached forms, Appendix A - Proposal Cover Sheet, Appendix B - Project Summary, and Appendix C - SBIR Proposal Summary Budget, should be downloaded and printed from the Internet or photocopied, and completed as indicated under Section IV, Proposal Preparation Instructions and Requirements. The purpose of these forms is to meet the mandate of law or regulation and simplify the submission of proposals.

Appendix A: Proposal Cover Sheet

U.S. Environmental Protection Agency,
SMALL BUSINESS INNOVATION RESEARCH PHASE I
SOLICITATION NO. PR-NC-01- 11782

PROPOSAL TITLE: _____

FIRM NAME: _____

MAILING ADDRESS: _____

CITY: _____ STATE: _____ ZIP: _____

AMOUNT REQUESTED:\$ _____ PROPOSED DURATION (PHASE I): 6 MOS

(Not to Exceed \$70,000)

*****Proposals submitted in response to this solicitation will be valid for 300 days*****

TOPIC (check one)

- ☐ A. Nanomaterials and Clean Technology
☐ B. Control and Monitoring of Mobile Source Emissions
☐ C. Prevention and Control of Air Pollution
☐ D. Treatment and Monitoring of Drinking Water
☐ E. Wastewater Treatment and Stormwater Management
☐ F. Hazardous Waste Management and Site Remediation
☐ G. Recycling of Municipal and Industrial Solid Waste
☐ H. Monitoring and Measurement Technologies

CERTIFICATIONS AND AUTHORIZATIONS: Answer Y(Yes) or N(No)

- ☐ 1. The above concern certifies that it is a small business concern and meets the definition as stated in the program solicitation.
☐ 2. The above concern certifies that a minimum of 2/3 of the research and/or analytical effort will be performed by the proposing firm.
☐ 3. If the proposal does not result in an award, is the Government permitted to disclose the title and technical abstract page of your proposed project, and the name, address, and telephone number of the official of the proposing firm to any inquiring parties?
☐ 4. The above concern certifies that it is a woman owned small business concern and meets the definition as stated in the program solicitation. *
☐ 5. The above concern certifies that it is a socially and economically disadvantaged small business concern and meets the definition as stated in the program solicitation.*
☐ 6. Do you plan to send, or have you sent, this proposal or a similar one to any other federal agency? If yes, which? Use acronym(s) for each agency, (e.g., DOD, NIH, DOE, NASA, etc.) _____
☐ 7. Choose one of the following to describe your Organization Type:
☐ Individual ☐ Partnership ☐ Corporation ☐ LLC
☐ 8. Provide the following information: Tax Identification No: _____
Dun & Bradstreet Number: _____ Common Parent Name: _____

* For information purposes only.

ENDORSEMENTS

Authorized Negotiator:

Print Name: _____

Title: _____

Telephone: _____

Fax: _____

E-mail: _____

Signature: _____

Date: _____

Person Authorized to Sign Proposal:

Print Name: _____

Title: _____

Telephone: _____

Fax: _____

E-mail: _____

Signature: _____

Date: _____

PROPRIETARY NOTICE: For any other purpose than to evaluate the proposal, this data shall not be disclosed outside the Government and shall not be duplicated, used or disclosed in whole or in part, provided that if a funding agreement is awarded to this offeror as a result of or in connection with the submission of this data the Government shall have the right to duplicate, use or disclose the data to the extent provided in the funding agreement. This restriction does not limit the Government's right to use information contained in the data if it is obtained from another source without restriction. The data in this proposal subject to this restriction is contained on pages _____ of this proposal.

Appendix B: SBIR Project Summary

U.S. ENVIRONMENTAL PROTECTION AGENCY
SMALL BUSINESS INNOVATION RESEARCH PROGRAM
SOLICITATION NUMBER PR-NC-01- 11782
PHASE I - FY 2002
PROJECT SUMMARY (Limit to One Page)

FIRM NAME, ADDRESS, TELEPHONE AND FAX NUMBER, AND E- MAIL ADDRESS:

Firm Name: _____ Telephone: _____
Address: _____ Fax: _____
_____ E-mail: _____

TITLE OF PROPOSAL:

TOPIC LETTER AND DESCRIPTION:

NAME AND TITLE OF PRINCIPAL INVESTIGATOR/PROJECT MANAGER:

TECHNICAL ABSTRACT, RESULTS, AND POTENTIAL COMMERCIAL APPLICATION

(Limit to 400 Words; Must be Publishable):

Appendix C: SBIR Proposal Summary Budget

(See Instructions on Reverse Side)

Organization and Address

A. DIRECT LABOR (PI and other staff, list separately) Hours/Est. Rate: \$

B. OVERHEAD: \$

C. OTHER DIRECT COSTS: (list separately) \$

D. TRAVEL: List purpose and individuals and or title \$

E. CONSULTANTS: (List Est. Rate and Hours) \$

F. GENERAL AND ADMINISTRATIVE: \$

TOTAL COSTS (Total of A thru F above) \$ _____

G. PROFIT (____ %) Not to exceed 10 % of total project costs \$ _____

TOTAL PROJECT PRICE (Total costs + Profit) \$ _____

PRINT NAME: _____

TITLE: _____

SIGNATURE: _____

DATE SUBMITTED: _____

This proposal is submitted in response to EPA SBIR Program Solicitation No. PR-NC-01-11782 and reflects our best estimate as of this date.

Instructions For Appendix C

The purpose of this form is to provide a vehicle whereby the offeror submits to the Government a pricing proposal of estimated costs with detailed information for each cost element, consistent with the offeror's cost accounting system.

If the completed summary is not self-explanatory and/or does not fully document and justify the amounts requested in each category, such documentation should be contained, as appropriate, on a budget explanation page immediately following the budget in the proposal. The form Appendix C will count as one page in the 25 page limit, and any budget explanation pages included will count separately toward the 25 page limit. (See below for discussion on various categories.)

- A. Direct Labor - List individually all personnel included, the estimated hours to be expended, and the rates of pay (salary, wages, and fringe benefits).
- B. Overhead - Specify current rate(s) and base(s). Use current rate(s) negotiated with the cognizant federal negotiating agency, if available. If no rate(s) has (have) been negotiated, a reasonable rate(s) may be requested for Phase I, which will be subject to approval by EPA. Offerors may use whatever number and types of overhead rates that are in accordance with their accounting systems and approved by the cognizant federal negotiating agency, if available.
- C. Other Direct Costs - List all other direct costs that are not otherwise included in the categories described above, i.e., computer services, publication costs, subcontracts, etc. List each item of permanent equipment to be purchased, its price, and explain its relation to the project.
- D. Travel - Address the type and extent of travel and its relation to the project.
- E. Consultants - Indicate name, daily compensation, and estimated days of service.
- F. General and Administrative (G&A) - Same as B. Above.
- G. Profit - Reasonable fee (estimated profit) will be considered under this solicitation. For guidance purposes, the amount of profit normally should not exceed 10% of total project costs.

Appendix D: Scientific and Technical Information Sources

State-of-the-art information, including service and cost details, useful in preparing SBIR proposals or in guiding research efforts may be obtained from the following sources:

National Technical Information Service (NTIS)
5288 Port Royal Road
Springfield, VA 22161
(513) 569-7562

EPA Headquarters Library (3404)
U.S. Environmental Protection Agency
401 M Street, SW
Washington, DC 20460
(202) 260-5922

The Hazardous Waste Collection and Database are available for use in the EPA Headquarters Library, the 10 EPA Regional libraries, EPA laboratories in Ada, OK; Edison, NJ; Las Vegas, NV; Research Triangle Park, NC, and the National Enforcement Investigations Center in Denver, CO. The Database runs on an IBM AT/XT or compatible equipment and may be purchased from NTIS using the NTIS order number PB87-945000.

The Environmental Quality Instructional Resources Center
1200 Chambers Road, R.310
Columbus, OH 43212
(614) 292-6717
[Especially related to Drinking Water and Wastewater Treatment]

National Small Flows Clearinghouse (SWICH)
P.O. Box 7219
Silver Spring, MD 20910
1-800-677-9424

[Topic themes include source reduction, recycling, composting, waste combustion, collection, transfer, disposal, landfill gas, and special wastes.]

ACCESS EPA (#055-000-00509-5) 1995 Edition

A consolidated guide to EPA information resources, services, and products. It provides access to:

Public information tools
Major EPA dockets
Clearinghouses and hotlines
Records management programs
Major EPA environmental databases
Library and information services
State environmental libraries

“ACCESS EPA” may be ordered at a cost of \$16.00 each from the U.S. Government Printing Office, New Orders, Superintendent of Documents, P.O. Box 371954, Pittsburgh, PA 15250-7954, or telephone (202) 512-1800, or from NTIS using order number PB-147438.

Vendor Information System for Innovative Treatment Technologies (VISITT) Profiles 325 innovative technologies available from 204 vendors to treat groundwater *in situ*, soil, sludges, and sediments. Includes technologies in all stages of development—bench, pilot, or full. VISITT is available at no charge on diskettes compatible with personal computers using DOS operating systems. To order VISITT diskettes and user manual, and to become a registered user, call the VISITT Hotline at 1-800-245-4505.

ENVIROSENSE

Internet: <http://www.epa.gov/envirosense>

ENVIROSENSE includes numerous databases and addresses industry and small business needs by establishing specific compliance assistance, pollution prevention, regulatory, and specific industry sector (SIC) data sets.

Appendix E: Commercialization Fact Sheet

(Finding Commercial Products; Conducting a Patent Search; Searching for Federal Research; Standards/Certifying Bodies)

FINDING COMMERCIAL PRODUCTS

The technology you are proposing may already be available in the market. There are five Web searches recommended as the minimum for determining if the technology is commercially available. In each case when you are having trouble, look for the FAQs (Frequently Asked Questions) or other advice on searching.

Web Search Using General Search Engines

There are around 320 million indexed Web pages and the Web continues to grow exponentially. One problem with this rate of growth is that no single Web search engine is capable of indexing the whole of cyberspace. We recommend using at least one meta-engine and two search engines.

A meta-engine is a search engine that searches other engines which actually catalog or index sites. Examples are Metacrawler, <http://www.metacrawler.com/>, and Dogpile, <http://www.dogpile.com>. We use that search to identify which search engines seem to be producing the best results and then use those engines for more complicated queries that cannot be supported by metacrawler and other meta-engines.

Two engines for more detailed searches at present are Hotbot's More Options page (<http://www.hotbot.com/default.asp?MT=&SM=MC&DV=7&RG=.com&act.super=+More+Options+&DC=10&DE=2&v=2&OPs=MDRTP>) and Alta Vista's Advanced Query Page (<http://www.altavista.digital.com/cgi-bin/query?pg=aq>). Both engines allow you to search newgroups (Usenet) as well as the Web. Hotbot has the largest number of pages indexed by any Web browser as of this Solicitation. Alta Vista has the next most extensive coverage. Unfortunately, queries are constrained to the options presented. Alta Vista supports any Boolean query you can design. Both sites have a search by subject feature that provides another path to sites of interest. Because Digital Equipment Corporation, which maintains Alta Vista, is a high-tech company, this engine has traditionally been strong on indexing science and technology sites.

When searching, expand or narrow your keywords over time. For example, when searching for "sapphire liquid crystal displays," you may want to broaden to liquid crystal displays or just displays. Also, remember to use abbreviations such as LCD.

Thomas Register of American Manufacturers: Long a staple of corporate buyers and market researchers, you can access Thomas Register online for free at <http://www.thomasregister.com/>. Once you obtain your free membership, you can search the 155,000 companies by product. You may have to try a few different keywords to get hits.

Hoovers: Hoovers online at <http://www.hoovers.com> provides access to profiles on over 12,000 companies. These are the major firms in America, including subsidiaries of foreign operations. By using the keyword search, you can look for companies making products in areas related to your technology. Hoovers provides hypertext links to go to the company's Web page. Phone, fax, and street address also are provided. If you cannot find the information on the Web, ask for relevant product literature from their marketing departments.

Press Releases: PR Newswire (<http://www.prnewswire.com/>) redistributes corporate press releases. It provides coverage of newly released products that might not otherwise be found on the Web.

Patents: We discuss patent searches in the next section of this fact sheet. Look for patents related to your technology, then examine the assignee field. Companies licensing or patenting technology in areas related to your technology are competitors that may be introducing products similar to the one you are considering proposing. Search for their Web pages using one of the resources above.

CONDUCTING A PATENT SEARCH

What is a patent? A patent is a right to an invention that is granted by the U.S. Government or a foreign government. It gives the holder an exclusive right to use an invention during a period of time. In the United States, before a patent can be issued, the inventor must demonstrate his or her invention is new and non-obvious. To be new, an invention must not have been known nor made by others in the United States. The invention also cannot have been previously patented or presented in a publication prior to the claimed date on which the invention was made. Patents are handled by the U.S. Patent Office.

Non-obvious is established with reference to what would be obvious to a person of ordinary skill in the relevant technology (or technologies) at the time of the invention. A general rule is that the more complicated the technology and the greater the rate at which it is developing, the higher the skill-level of that hypothetical ordinary person. Non-obvious is determined by examining prior patents, technical publications, and non-secret work being conducted. Usually some aspect of an invention will be non-obvious and thus capable of being patented.

It is important to recognize that different rules apply in different countries. In the United States, you have 1 year from the time of first disclosure, use, publication, or sale of an invention to patent the invention. Where more than one person or group makes a claim to be the inventor, the patent goes to the person or group that can demonstrate priority in time. Overseas, the rules are different. Usually the invention must be patented before any public disclosure, use, publication, or sale. In case of a dispute, priority goes to the first person or group to apply for a patent, regardless of who may actually be the inventor. You can, however, get the same overseas priority rights you would get from simultaneously filing overseas and in the United States if you file in each relevant country within 12 months of a U.S. patent application.

How to search for U.S. patents: There are two free Web sites useful for searching for U.S. patents: the U.S. Patent Office and Delphion's Patent Server. To search the Patent Office go to <http://patents.uspto.gov/index.html>. The Delphion server is at <http://www.delphion.com/>.

The Boolean search capability of the Patent Office enables constructing complicated searches to narrow in on patents of interest. It allows two terms Booleans in the first search, with more complicated queries when refining a search. You can search specific sets of years or the entire database. The advanced search gives you the ability to look in any or all of the fields in the patent — a very nice feature. Coverage includes all patents issued no later than one week earlier. It includes all utility, design, and plant patents since 1976. Claims and pictures are not included. (See below, Reading Patents.)

The IBM Patent server contains over 2 million patents. Where drawings are part of the patent, they have been scanned in and can be viewed. Off the home page, you have the option of searching from 1995 to present or 1971 to present. Hypertext links on the home page let you search by patent number, use Boolean Logic, or do a text search in various sections of the patent. Try to be as targeted as possible in your search terms. For example, "environmental monitor" will return 42 patents issued in 1995 or later on IBM's server. "Mercury monitor," by comparison, returns only three.

Reading Patents: Once you have found a patent that looks relevant for your interests, examine the abstract and the claims. The abstract provides an overview of what is covered. The claims give you the specific scope of the patent.

There are three paths for finding other patents of interest, once you have found the first one. The first method is to look at the class (or classes) of the patent. You can find patents addressing similar problems by looking in those classes. To fine tune the classes to use, look at a number of relevant patents. Examine the classes that are listed on the patent. Select those classes that most frequently appear across your sample of patents for further examination.

The second method is to look at the patents cited as references. The final method is to look at patents that reference the one you are examining. By searching text, relevant classes, and patents referred to or referencing relevant patents you can quickly determine if a U.S. patent has been issued on a technology of interest. CAUTION: Examining U.S. patents does not assure you the technology has not been patented elsewhere. Further, if the patent is only applied for and has not yet been issued, you will not find it.

SEARCHING FOR FEDERAL RESEARCH

There are two sets of publicly available data on Federal Research. FEDRIP, or Federal Research in Progress, provides access to current civilian agency research. FEDRIP includes:

- Department of Agriculture (USDA)
- Department of Energy (DOE)
- Department of Veterans Affairs (VA)
- Environmental Protection Agency (EPA)
- Federal Highway Administration (FHA)
- National Institutes of Health (NIH)
- National Aeronautics and Space Administration (NASA)
- National Science Foundation (NSF)
- U.S. Geological Survey (USGS)
- National Institute of Standards and Technology (NIST)
- Nuclear Regulatory Commission (NRC)
- Small Business Innovation Research (SBIR)

Parts of FEDRIP may be searched for free at The Community of Science, <http://fundedresearch.cos.com/>. Separate databases exist for the National Institutes of Health, NSF, USDA, and the SBIR program—which means you must do multiple searches. You also can search projects of the Medical Research Council of the United Kingdom. To search all of FEDRIP, go to <http://grc.ntis.gov/fedrip.htm>. There is a \$350 fee.

In addition, by going to an agency's Web site, you can find information on their current and/or past awards. The National Technical Information Service (NTIS) is the designated repository of research reports. It contains technical reports and other government-produced information products. The free access parts may be searched at <http://www.ntis.gov/>. For the fee-based access, see <http://stinet.dtic.mil/>.

DoD material can be searched through the Defense Technical Information Center (DTIC). Public access searching is at <http://stinet.dtic.mil/>.

Perhaps the best comprehensive resource for searching is the RAND's RaDiUS at <http://www.rand.org/radius/>. RaDiUS, stands for "Research and Development in the United States." It is the first comprehensive database that tracks in real-time the research and development activities and resources of the U.S. Government. Among its sources are the following: the Catalog of Federal Domestic Assistance (CFDA); USDA's Current Research Information System (CRIS); HHS's Computer Retrieval of Information on Scientific Projects (CRISP) and Information for Management, Planning, Analysis, and Coordination (IMPAC) systems; DoD's R-1 and R-2 Budget Exhibits and Work Unit Information Summaries (WUIS); DOE's laboratory information system; the Federal Assistance Awards Data System (FAADS); the Federal Procurement Data System (FPDS); OMB's MAX system; DVA's R&D Information System (RDIS); NSF's Science and Technology System (STIS); and NASA's 507 System.

You must be a Government Contractor to subscribe to RaDiUS. The small business fee is \$1,000 per year per password.

STANDARDS AND CERTIFYING BODIES

If you are going to introduce a commercial product, it most likely will have to meet certain standards and be certified as meeting those standards. For example, we all are familiar with the Underwriter Laboratories (UL) seal found on household electrical products—a certification of safety under normal use.

A wide range of bodies creates standards or certifies products. To find relevant standards, we recommend beginning at the American National Standards Institute's "Internet Resources for Standards Developers," located at: <http://web.ansi.org/public/library/internet/resources.html>. The site provides links to U.S. bodies developing standards.

If you are anticipating overseas sales, be aware that you will need to identify relevant foreign and international standards. The place to begin is the International Organization for Standardization. Their list of links to standards bodies is at <http://www.iso.ch/addre.html>.

In the United States, private sector laboratories, like UL commonly do certification. These organizations rely on standards developed by consensus bodies such as the American Society for Testing and Materials (<http://www.astm.org/>) or federal agencies such as EPA. ASTM maintains an International Directory of Testing Laboratories at: <http://www.astm.org/labs/index.html>. The Directory can be searched by geographic location, laboratory name, subject area, or keywords.

IMPORTANT!!

IF YOU WISH TO RECEIVE AN ACKNOWLEDGMENT CARD TO CONFIRM RECEIPT OF YOUR PROPOSAL, PLEASE COMPLETE A STANDARD SELF-ADDRESSED POSTCARD CONTAINING THE FOLLOWING INFORMATION AND ATTACH TO THE **ORIGINAL** OF EACH PROPOSAL:

Please type the following and fill in the blanks as appropriate:

This will acknowledge the receipt of your proposal titled:

Topic Letter _____. The evaluation of proposals and the award of SBIR Contracts will require approximately 10 months, and no information on proposal status will be available until final selection(s) is made. Your proposal has been assigned EPA No. _____ (to be filled in by EPA).

Date: _____

REVERSE SIDE: Please type the following in the upper left-hand corner (return address) and self-address the card to your corporate official. (Post cards that do not meet not postal service standards will not be returned.)

U.S. EPA
CONTRACTS MANAGEMENT DIVISION (MD-33)
RESEARCH TRIANGLE PARK, NC 27711

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE \$300

YOUR FIRM NAME

ADDRESS

CITY, STATE, ZIP CODE